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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	McDonnell Douglas Missile Systems Company St. Louis, Missouri 63166
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Technology Insertion (TI)/Industrial Process Improvement (IPI) Data Base Documentation Book Volume, for OO-ALC/MANPRC (Metal Coatings) Book 1 of 2 This document contains detailed information about layouts equipment and processes for this RCC.

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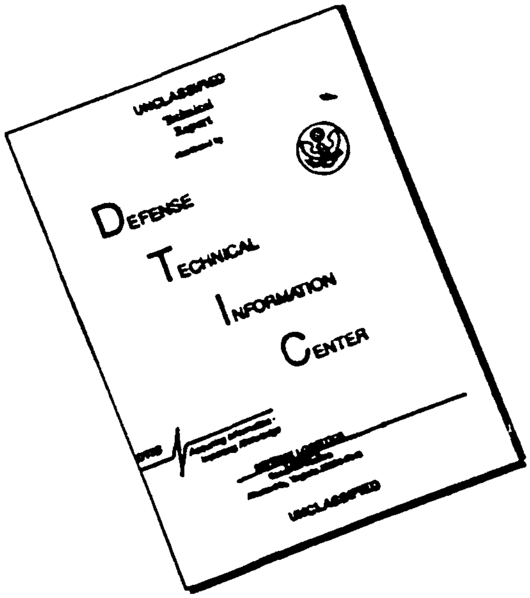

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TECHNOLOGY INSERTION-ENGINEERING SERVICES PROCESS CHARACTERIZATION TASK ORDER NO. 1

BOOK 1 OF 2

DATABASE DOCUMENTATION BOOK

OO-ALC

MANPRC

(OVERVIEW LAYOUTS)

CONTRACT SUMMARY REPORT
15 DECEMBER 1989

A-1

CONTRACT NO. F33600-88-D-0567
CDRL SEQUENCE NO. B008

MCDONNELL DOUGLAS
McDonnell Douglas Missile Systems Company
St. Louis, Missouri 63166-0516 (314) 232-0232

TABLE OF CONTENTS

1.0 IDENTIFICATION OF RCC

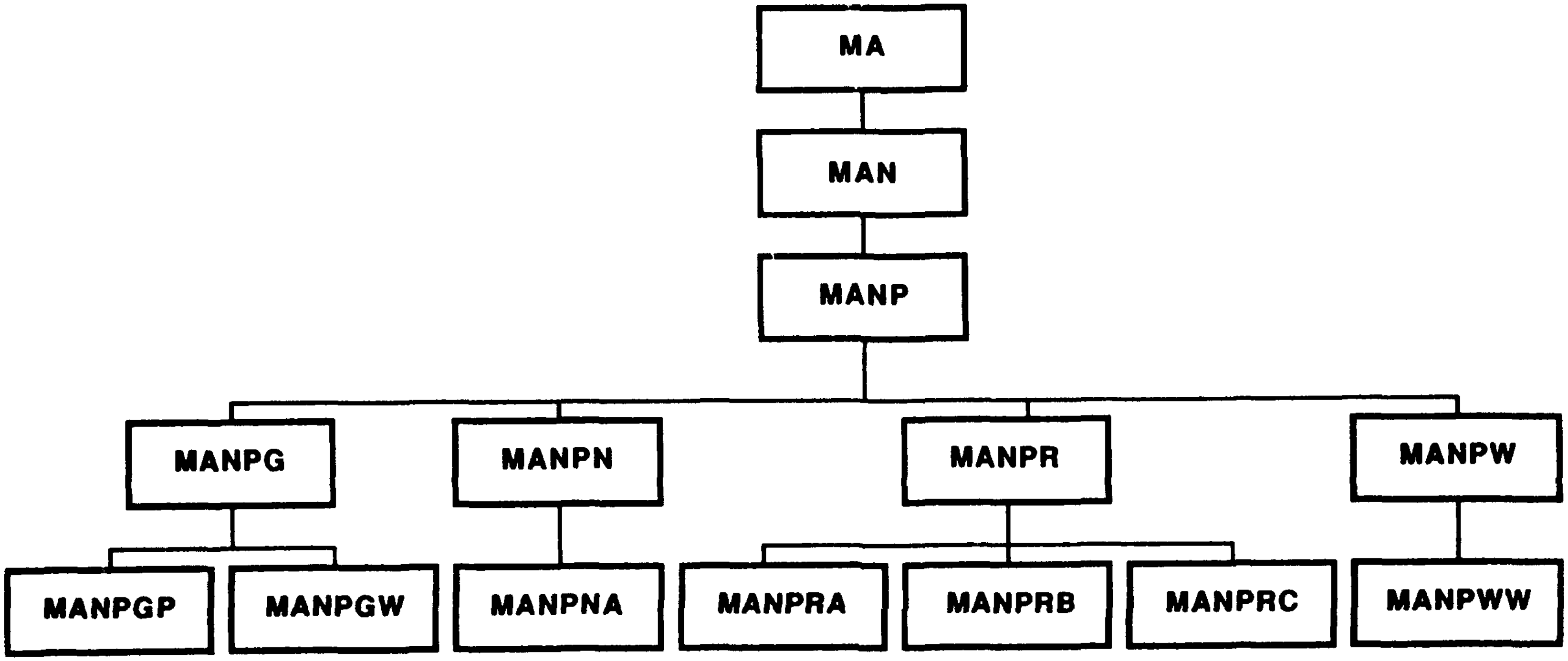
RCC MANPRC has been identified by the SOW of Contract F33600-88-D-0567 for Process Characterization.

2.0 GENERAL INFORMATION

L7 MANPRC is a Resource Control Center (RCC) under the Production (MANP) branch of the Industrial Products Division (MAN) at OO-ALC and performs various manufacturing and repair operations under the Repair Support Section (MANPR) relative to metal coating/metal protective (inorganic) surface finishes.

Approximately 90 % of the workload in MANPRC is Management of Items Subject to Repair (MISTR) with the remaining 10 % divided equally between Planned Depot Maintenance (PDM) and Temporary (MANUFACTURE).

The primary function of MANPRC is to support repairs of aircraft landing gear, including brakes, struts and wheels.

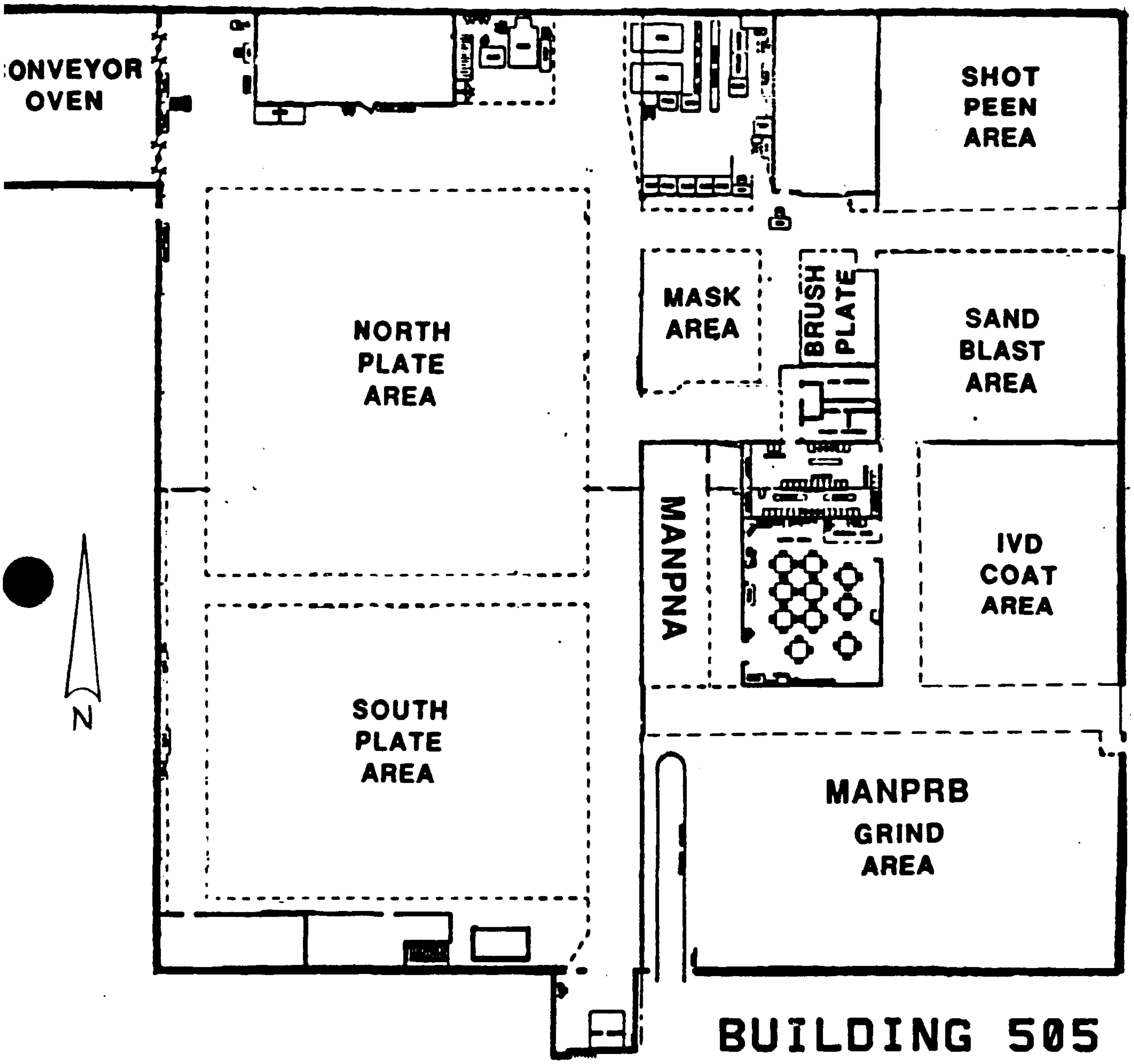


LEGEND:

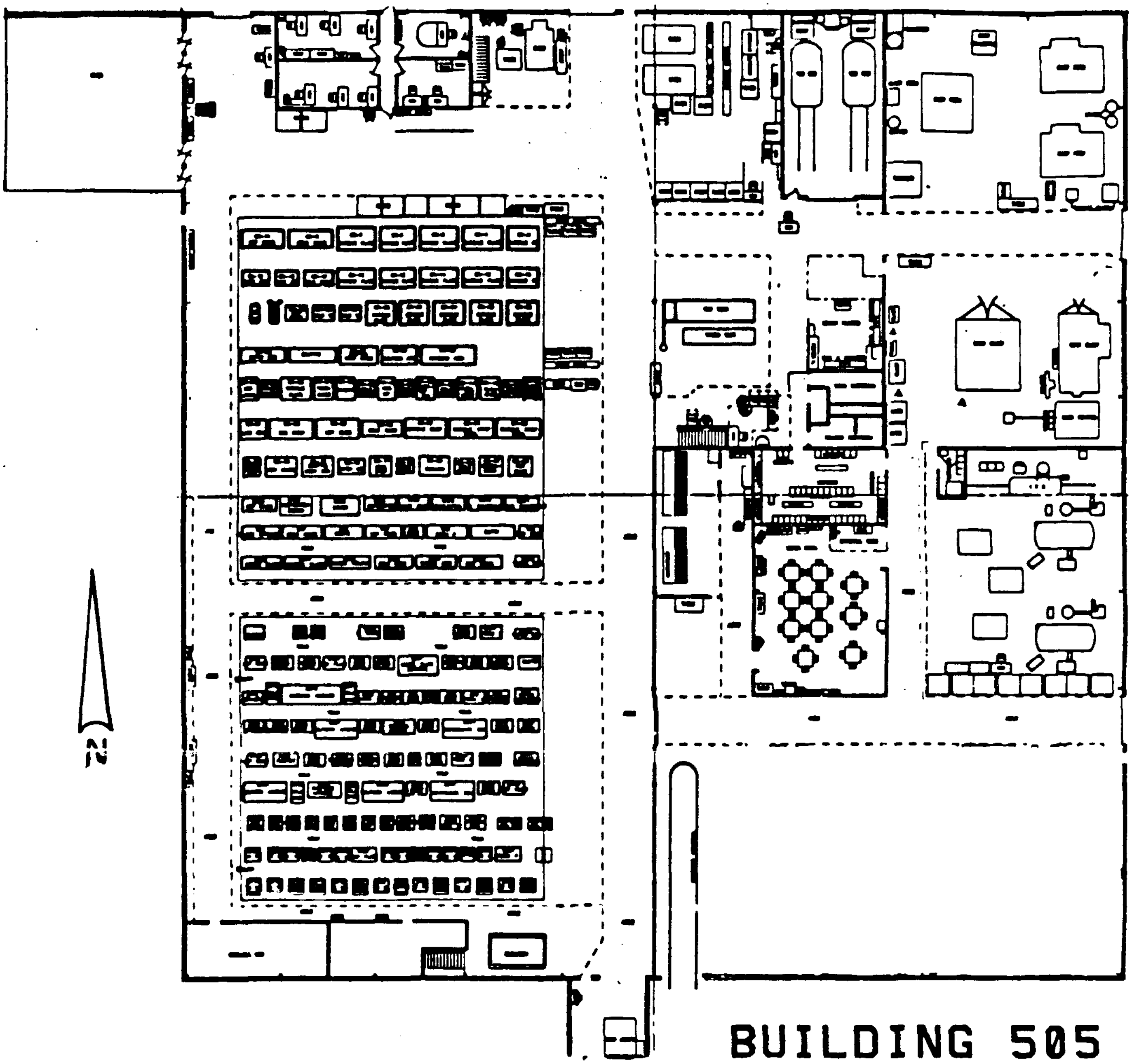
MA = DIR. OF MAINT.
MAN= INDUSTRIAL PRODUCTS & L. G. DIVISION
MANP = PRODUCTION BRANCH
MANPG = LANDING GEAR SECTION
MANPGP = ASSEMBLY UNIT
MANPGW = DISASSEMBLY UNIT
MANPN = NONDESTRUCTIVE TEST SUPPORT SECTION
MANPNA = NONDESTRUCTIVE TEST UNIT
MANPR = REPAIR SUPPORT SECTION
MANPRA = MACHINING SHOP REPAIR UNIT
MANPRB = GRINDING UNIT
MANPRC = PLATING UNIT
MANPW = MISC. MANUFACTURING/REPAIR SECTION
MANPWW = FLAME SPRAY UNIT

OO-ALC RCC PROCESS CHARACTERIZATION COVERAGE
FIGURE 7.6.1-1

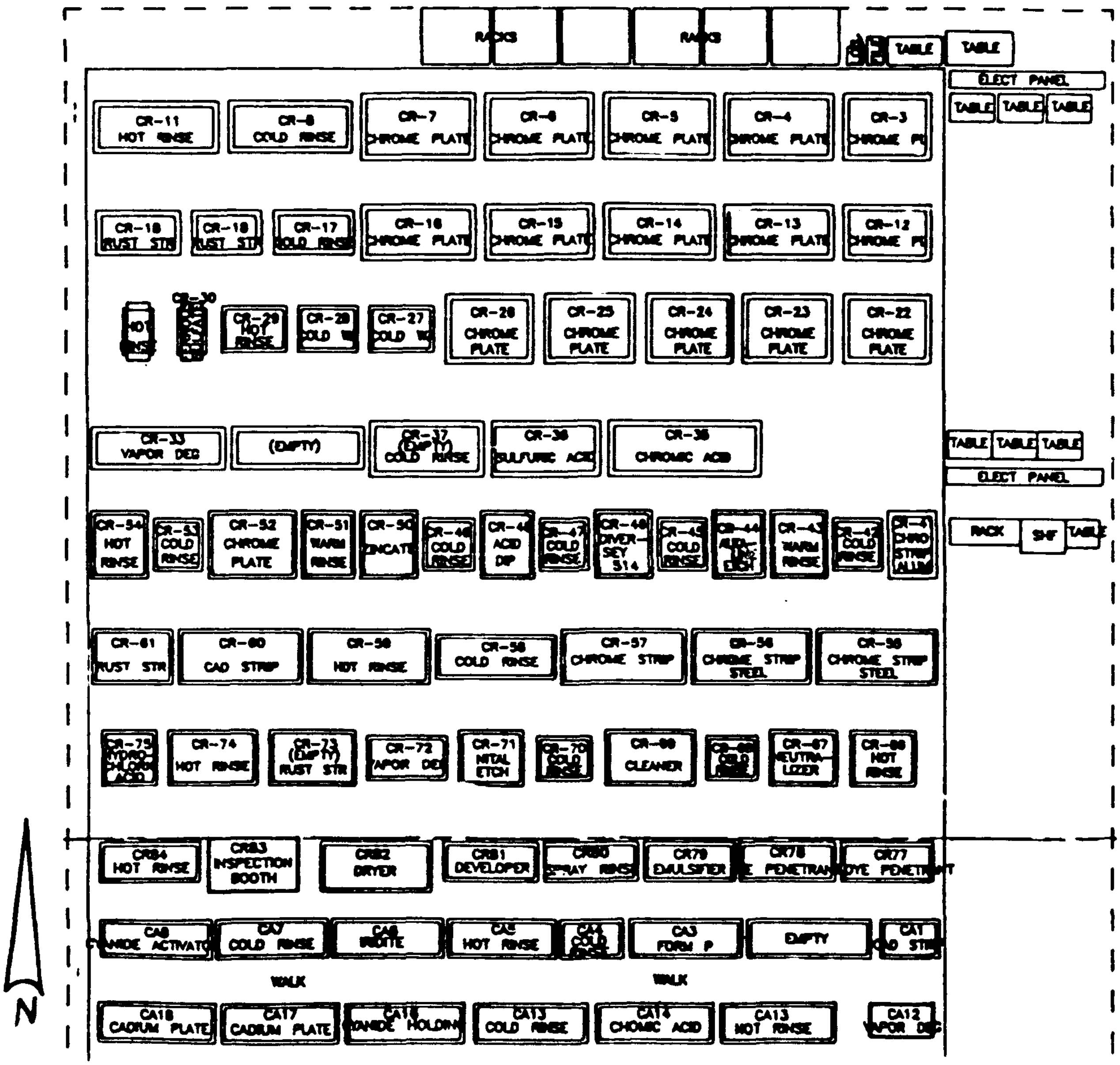
LSC-20376



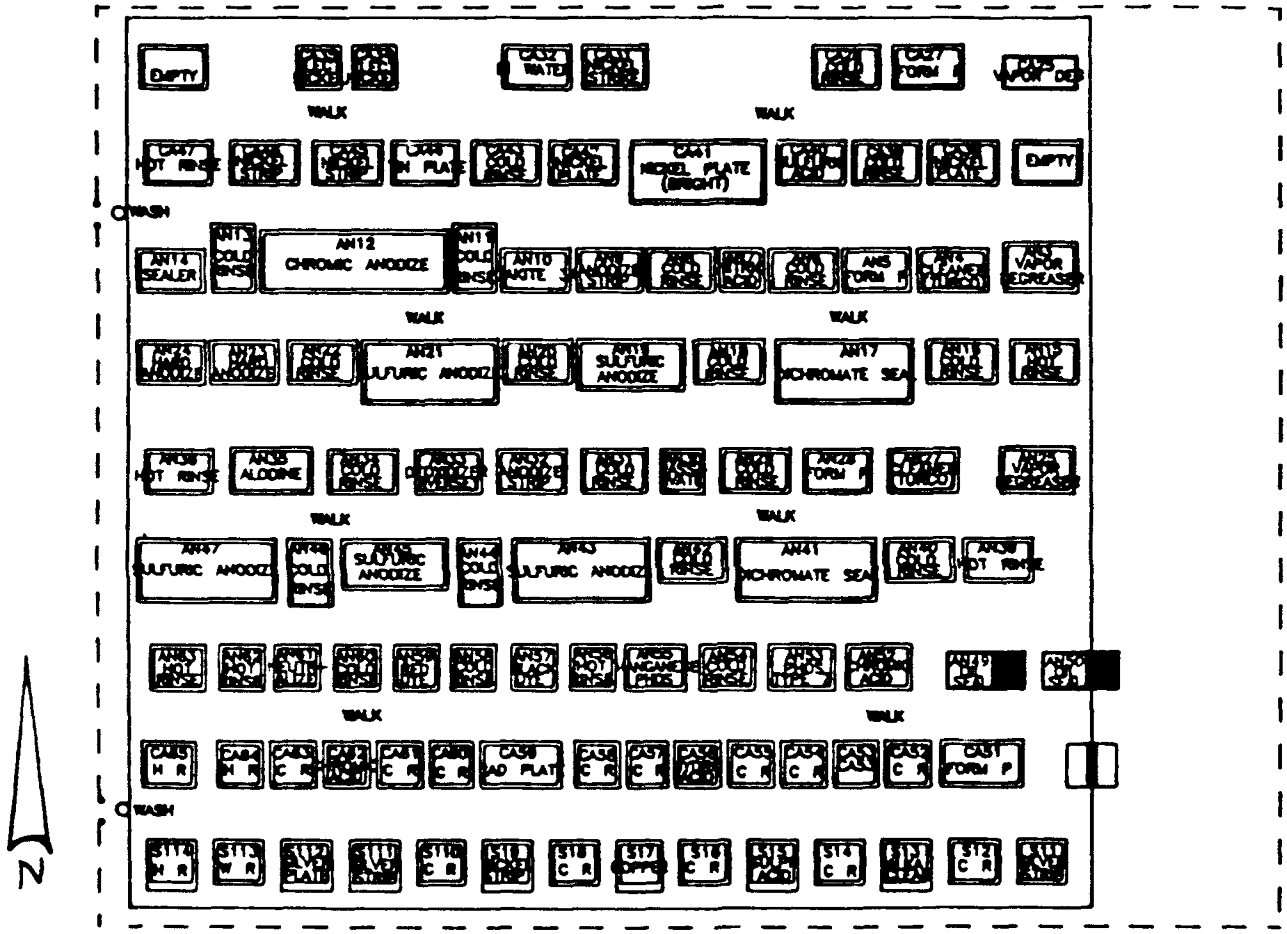
MANPRC WORK AREAS



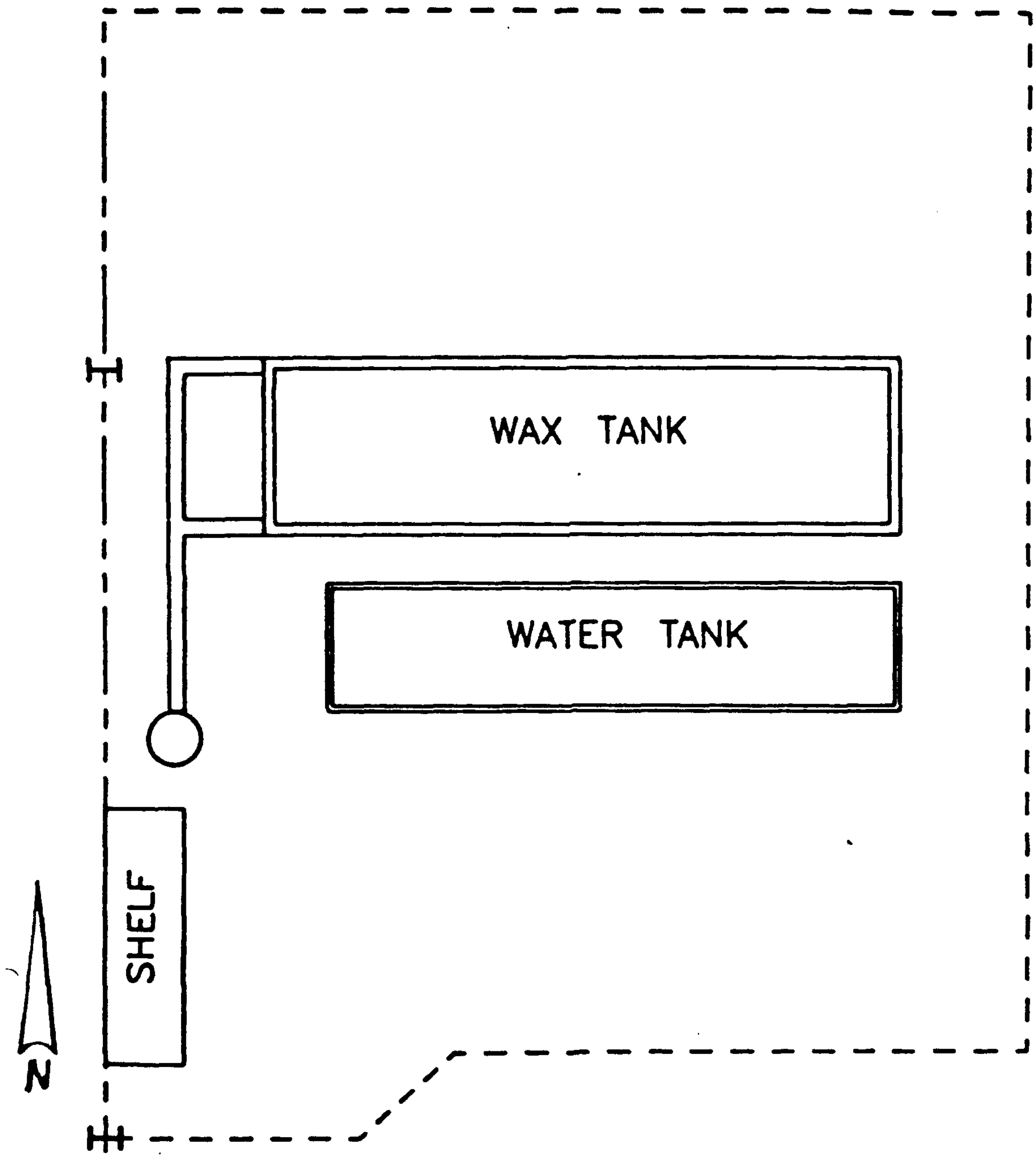
MANPRC AREA LAYOUT



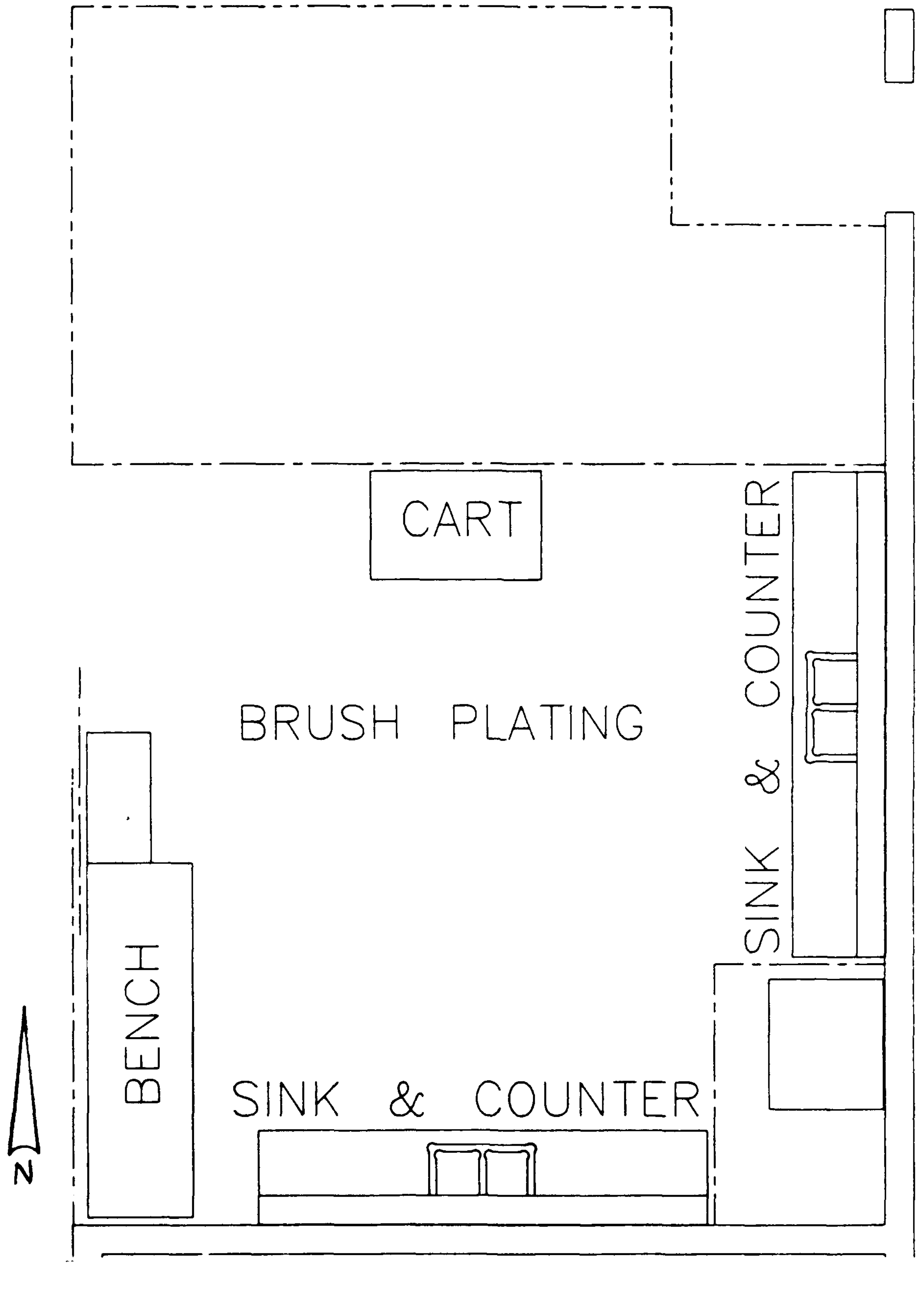
MANPRC NORTH PLATE AREA LAYOUT



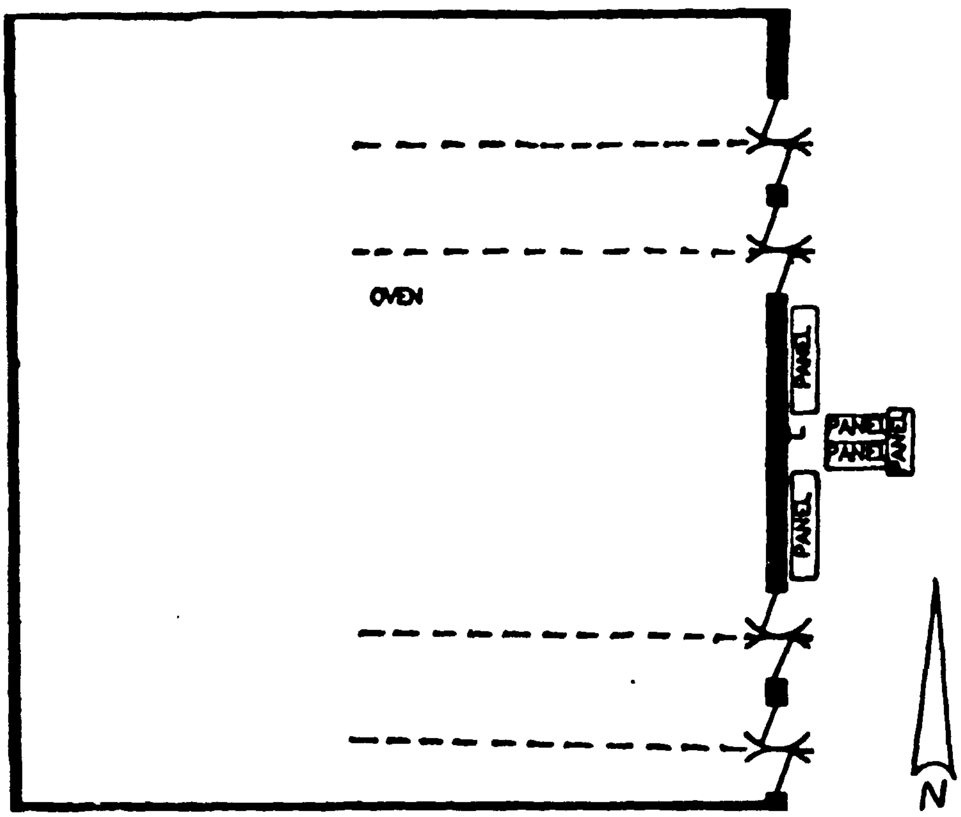
MANPRC SOUTH PLATE AREA LAYOUT



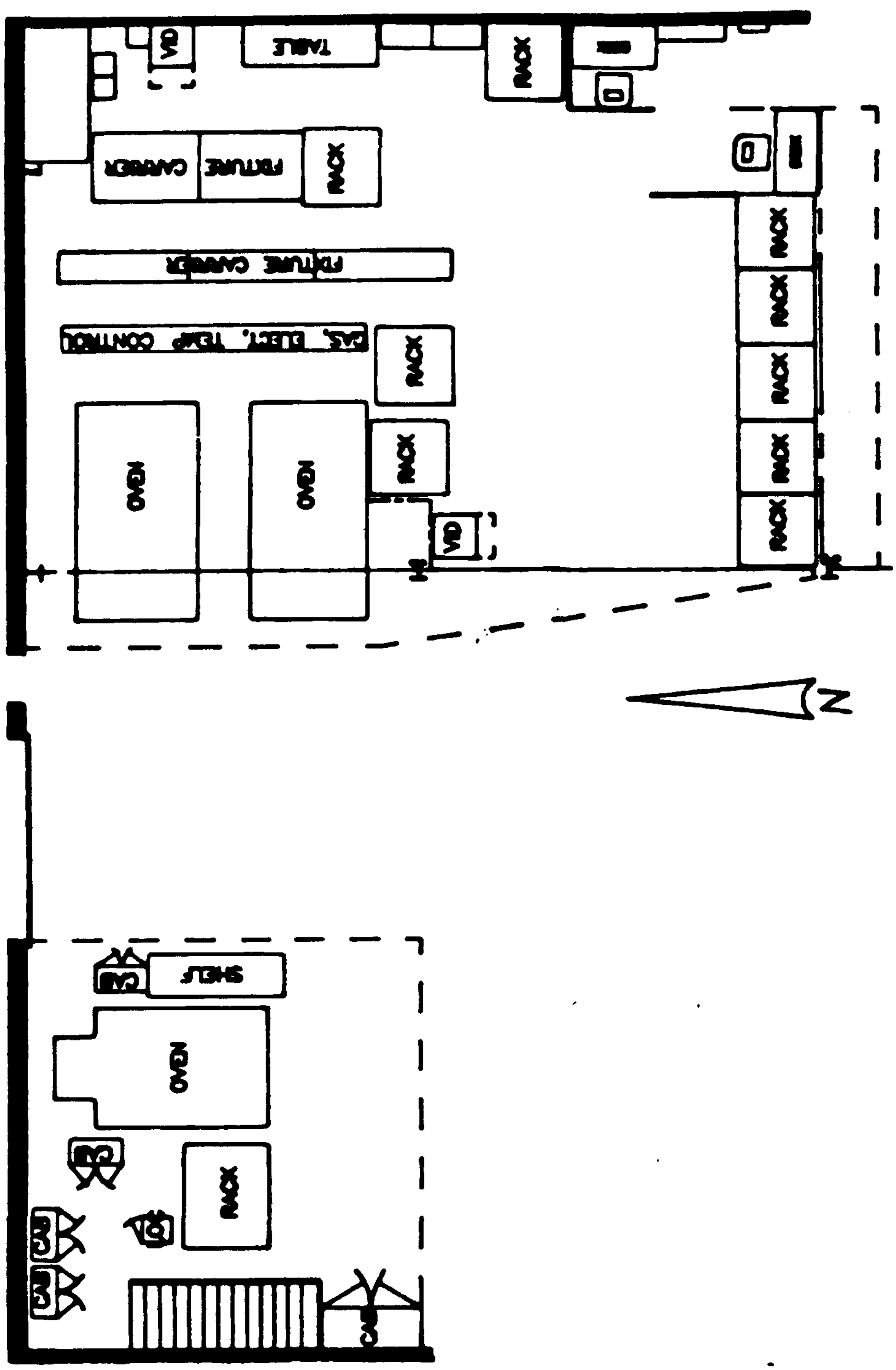
MANPRC HOT DIP MASKING AREA LAYOUT



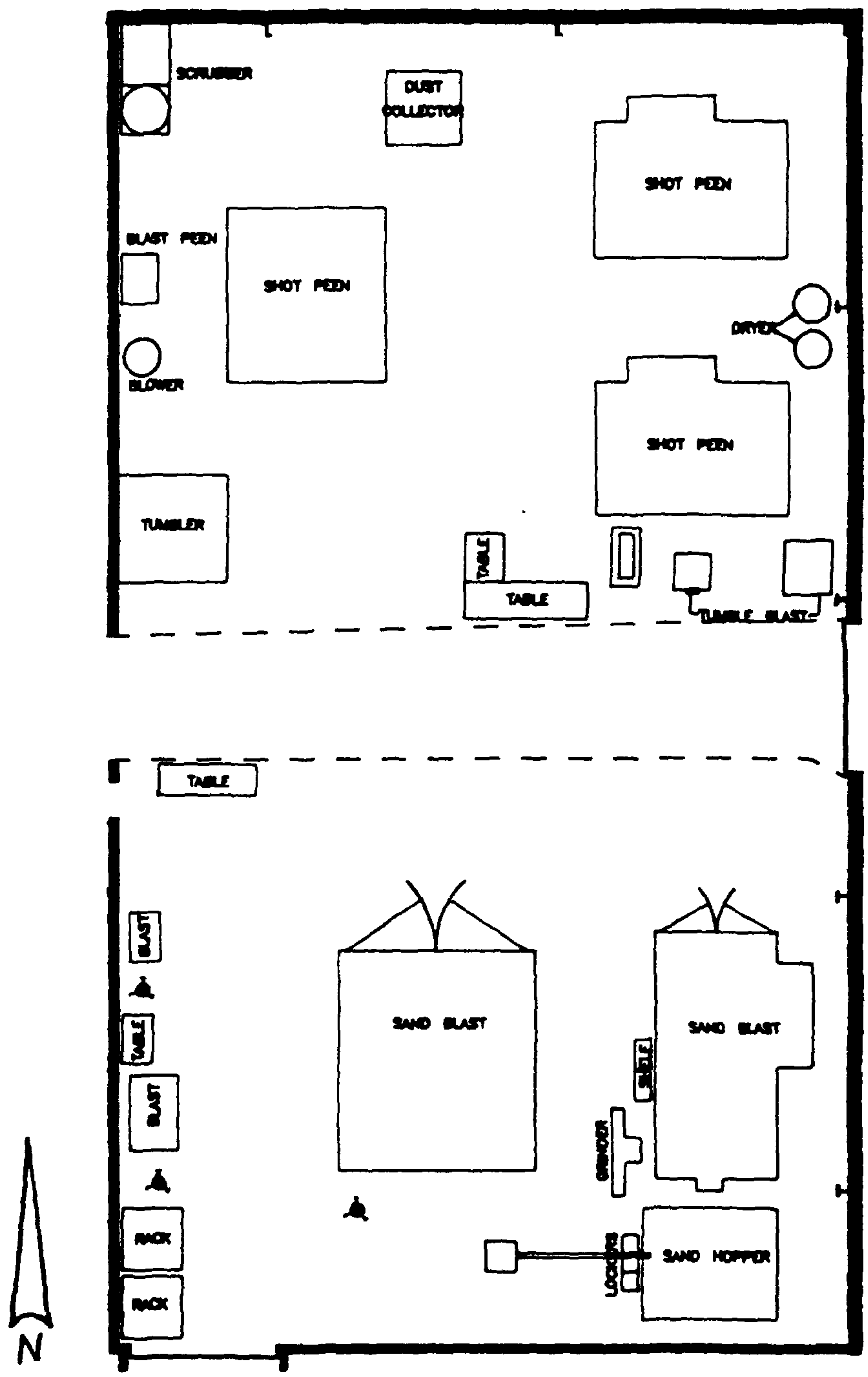
MANPRC BRUSH PLATING AREA LAYOUT



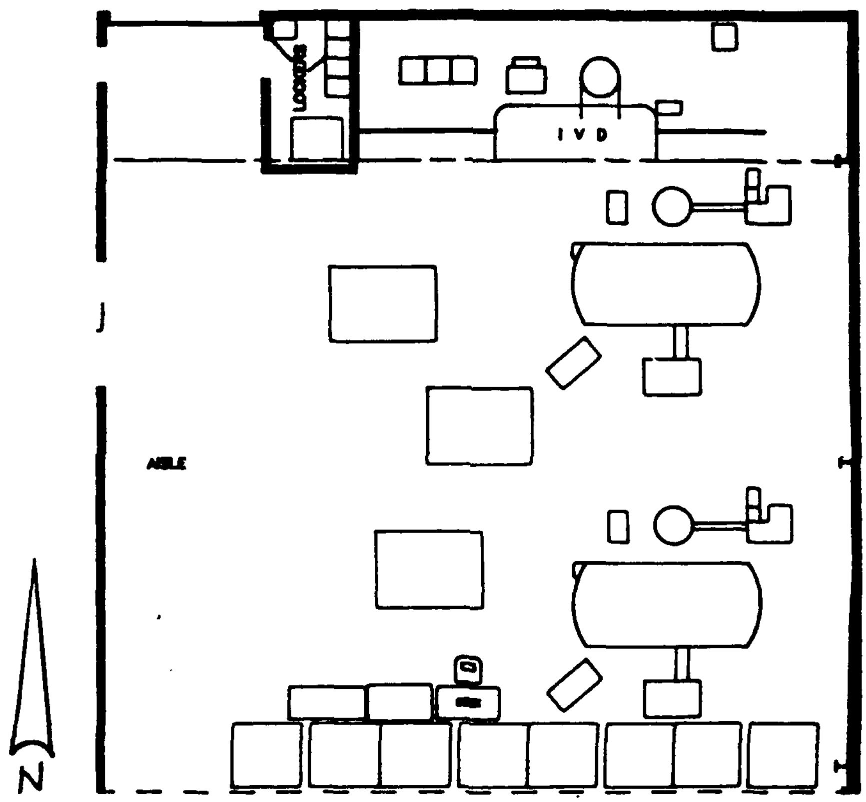
MANPRC CONVEYORIZED BAKE OVEN



MANPRC BATCH BAKE OVENS



MANPRC SAND-BLAST/GRIT-BLAST AREAS



MANPRC ION-VAPOR DEPOSITION AREA

OVERALL MANPRC FACILITIES LAYOUT A[illegible]

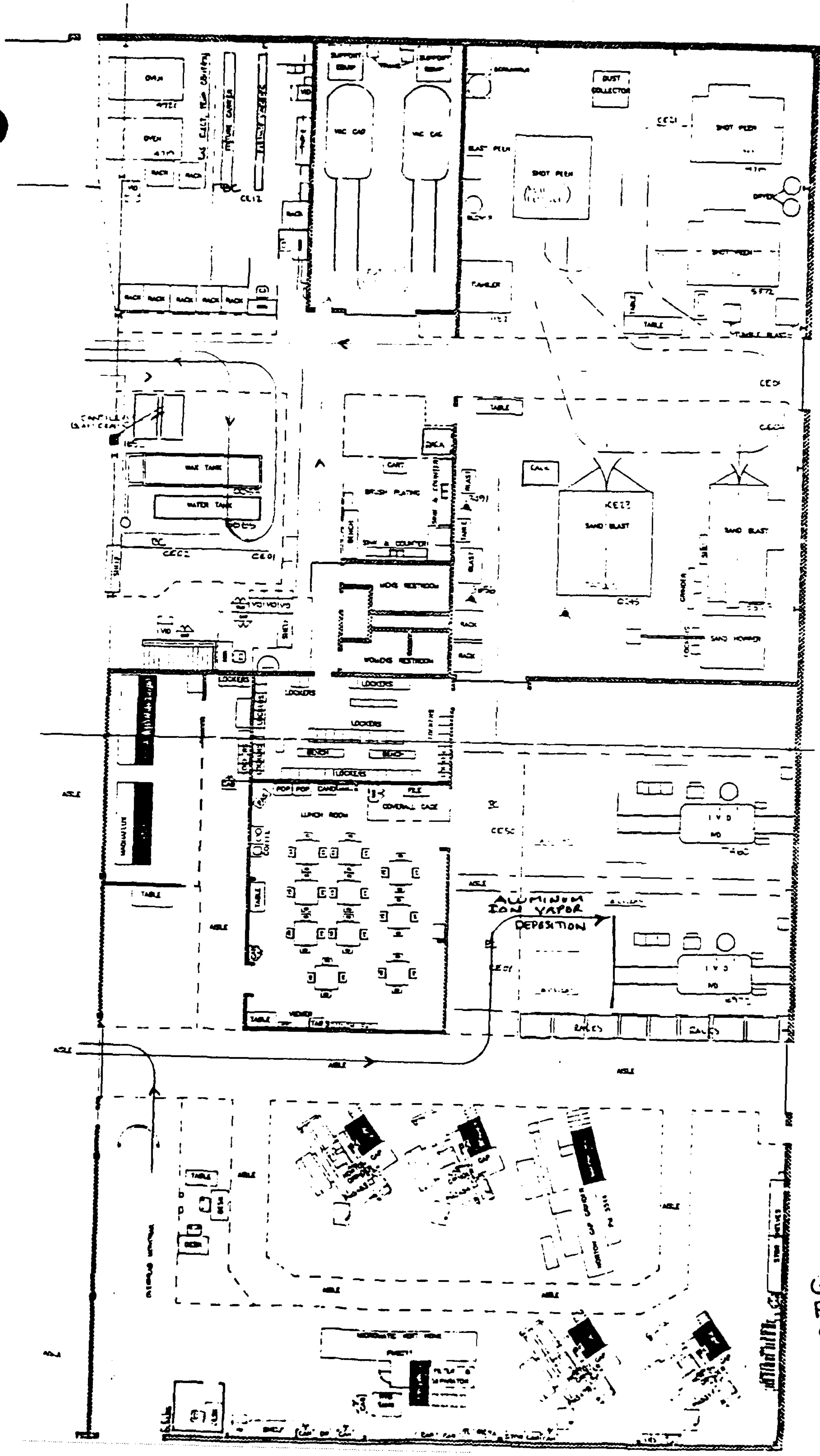
The overall assessment of the facilities is good with the exception of the wet-chemical tank areas (505N/505S). It is recommended that a Focus Study be made toward a total renovation of the two areas with emphasis on significant improvements in work flow and transport of parts via a suitable hoist system.

The layout configurations of the tanks are that of the late 1960's technology when the Facility was designed for implementation (construction) approximately FY 72 era. The tanks in both areas are layed-out in the end-to-end style which doesn't allow for any versatility and economizing on floor space and allowing for expedient and time-saving work flow of parts. Parts must be removed from one monorail hoist track and placed on another monorail to complete the process.

Drag-out of chemical solutions with resultant contamination of other tanks result from insufficient strategically placed water rinse tanks on some lines. Also, the que of parts at either end of each and in conjunction with work in process (WIP) makes navigation of personnel difficult and dangerous. Improved schedules of work release could alleviate some of the condition along with applicable storage racks rather than a multitude of skids loaded with parts on floor accesses to the treatment lines.

R. Burdett - 6/7/?

THE OVERALL LAYOUT OF THE FACILITIES IS VERY GOOD. HOWEVER THE LAYOUT OF THE INDIVIDUAL PROCESS TANKS SHOULD BE RE-ANALIZED. FOR BETTER FLOW OF PARTS. CURRENTLY THERE ARE PARTS THAT HAVE TO BE RE-CONNECTED TO. ANOTHER MONORAIL SYSTEM TO FINISH THE PROCESS. THERE ARE ALSO SEVERAL PLACES WHERE THE PART CONTAMINATES A TANK (DRIPS SOLUTION INTO) WHILE BEING MOVED OVER IT TO GET TO ANOTHER TANK.



GENERAL
PROCESS FLOW
CHART
2 OF 2

ASSESSMENT OF EQUIPMENT PER MANPRC

MANPRC occupies the entire floor area of Bldg. 505 with the exception of approximately 20% of the Building devoted to a large grinding machines plus an area for magnetic particle inspection and finally, one entire wet-chemical Line (No. 8) is used for dye-penetrant inspection of castings. The area devoted for MANPRC comprises all equipment required to perform the mandated wet-chemical processing and the non-chemical coating operations such as grit-blasting, shot peening and oven-baking (including a novel conveyorized oven for two widely-different bake cycles), the application of both metallic and non-metallic coatings to metal surfaces for corrosion resistance (chromate coating of aluminum and the cadmium plating of steel), engineering requirements (heavy chromium plating of bearing and journal surfaces on landing-gear cylinders) and for acceptable adhesion of organic coatings (anodizing of aluminum). In addition, a non-aqueous coating of commercially-pure aluminum is applied using the ion-vapor deposition process which greatly reduces the use of toxic cadmium plating (both from the cadmium metal itself in addition to the toxic cyanide electrolyte.

Excellent facilities exist for grit-blasting to remove both corrosion product and metal oxides, shot-peening for stress-relieving metallic surfaces and oven-baking to relieve both the effects of hydrogen embrittlement and service-induced stresses. While the existing facility for the hot melt

plastic masking is adequate although economically-expensive, the recommended use of a hot-melt wax maskant by McDonnell Douglas Missile Systems Co. (MDMSC) would be very economical but would entail the acquisition and subsequent implementation of additional equipment for which suitable floor space is available (Ref: Task Order No. 7 Phase I Reports). The selective (brush) plating facility appears more than adequate for operations not only in the RCC but also remains portable to permit repair operations on operational aircraft.

MANPRC has approximately 110 wet-chemical tanks. These tanks, as well as that equipment previously-noted, are listed in the Equipment Profile (Sec. 5.0). An extensive renovation of Tank Lines Nos. 16 – 19 was being performed during the Assessment. The original equipment/tanks for the RCC are approximately 17 years of age (FY72 acquisition) per G. Roylance – Foreman. The chemical tanks are arranged end-to-end style in the technology of the late 1960 era and having each of nine monorail hoists servicing two lines with one monorail hoist servicing only one Line (Line No. 19). Figures I and II show the as-is configuration of the wet-chemical areas and tank contents as of 5-23-89 lock-in date. Note that the 5-23-89 lock-in date was mandated due to the many on-going changes being made in MANPRC due partially to the extensive renovation previously noted.

Although the sizes of the tanks vary considerably both in "footprint" area and in solution volumes and in the physical shapes, the tanks appear to be adequate to contain the parts for processing. A better designed monorail hoist system with "parking" side-rails and with the same, existing tank arrangement would help considerably for movement of parts. The next overall renovation of MANPRL should include a Focus Study into a re-arrangement of the wet-chemical tanks in conjunction with the use of bridge cranes having remote-controlled (TV Remote Control-type), hand-held bridges and hoists. This type of part transport system is being considered by WR-ALC in their up-coming Facilities Improvement Project (FIP). Note reference to ITDMSC Task Order No. 5 - Phase I. The total re-arrangement of the tanks would allow for greater economic utilization of floor area while offering increased versatility in the performance or the many varied operations performed by MANPRL.

While some of the tank lines and/or chemical operation process flows have more than adequate water rinse tanks, other lines/processes do not. For example, tank lines No. 1, 2 and 4 have only one Cold Water Rinse tank located near end of line and only two Hot Water Rinse tanks exist for all of tank lines Nos. 1, 2, 3 and 4. This allows for needless drippage, to the main floor and the basement floor (through the steel grating), of extremely toxic

and corrosive hexavalent chromium solution.

Maintenance of not only the tanks and some of the ancillary equipment associated with the chemical operations could be improved. The deterioration of the cathode rod agitator rollers on tank CA-41 (Equipment No. 5849), containing a bright Watts Nickel plating solution, has progressed to the point that the 1.5 inch diameter solid copper buss is no longer contacting the hard rubber rollers placed at each end and at center of tank. A heavy lubricating grease has been applied to provide some lubricity to the center roller. Considerable chemical problems could result to the bright Nickel Plate solution up to and including total discard and re-make if either the solution or the considerable amount of foam in the tank contacts the grease.

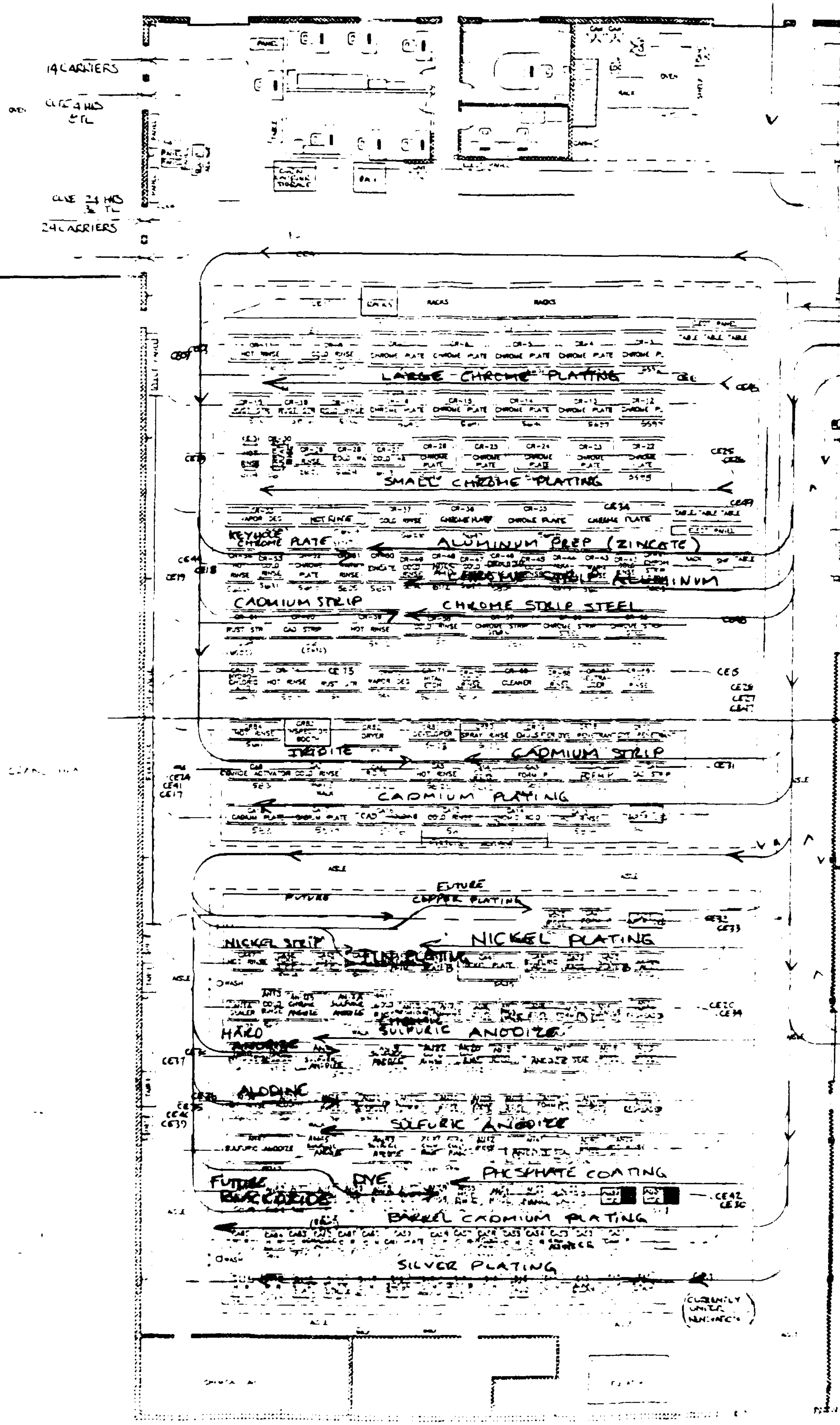
The facilities and equipment for hard chromium plating of landing gear parts is state-of-art utilizing the two-buss system. Cast lead "bird-cage" conforming anodes (used for the plating of outside surfaces of cylindrical parts and specially-designed conforming anodes (combination of lead and ethylene propylene-plastic) for inside surfaces of cylindrical parts are designed and fabricated within the ALC including the casting of lead-metal parts to the rather complex conforming anodes.

The two Ion-Vapor Deposition (IVD) facilities are becoming increasingly utilized for parts up to and including the C-141 Main Outer Cylinder. Size of the

deposition chambers do not permit the processing or larger parts such as the B-52 and C-5 Main Outer Cylinders. The other main limiting factor on IVD aluminum deposition is the ratio of hole diameter to depth of hole to deposit the same thickness of aluminum as on outside surfaces. Parts with holes can be deposited to the same thickness only to a depth of a hole 0.5 x the diameter of the hole. One of the operators of the IVD machines, R. Newton, stated that he and five other personnel attended an IVD Training Class in St. Louis, MO at MCAIR very recently. MCAIR recommended a deposition thickness of 0.015 inches vs the 0.005 inches presently performed and also the use of a glass-bead shot-peen stress relief following deposition. The glass-bead shot-peening is not available in MMPRC. A study is warranted concerning the acquisition and subsequent implementation of suitable glass-bead shot-peen equipment.

The storage of Work In Progress (WIP) requires some concentrated attention and study. Parts are typically blocking aisles at periphery of the wet-chemical tank areas making walking and the transport of parts difficult. Improved control of number of parts released for actual processing is needed to relieve this condition if only for safety considerations.

R. Bishoff - 6/6/89



GENERAL PROCESS FLOW CHART

1 OF 2

EQUIPMENT PROFILE

CODE	DESCRIPTION
A	ALUMINUM
ACT	ACTIVATOR
ALKA	ALKALINE
ANZ	ANODIZE
BC	BRIDGE CRANE
CAD	CADMIUM
CANT	CANTILEVER
CHR	CHROME, CHROMIC
CLN	CLEAN
CYANID	CYANIDE
DEG	DEGREASE
FS	FERROUS SULFATE
HYDRC	HYDROCHLORIC
IVD	ION VAPOR DEPOSITION
MANG	MANGANESE
NI	NICKEL
NIB	NICKEL BRIGHT
NIS	NICKEL SULFAMATE
NITR	NITRIC
PHOS	PHOSPHATE
S	STEEL
SILV	SILVER
STRIK	STRIKE
STRP	STRIP
SULF	SULFURIC
SULFM	SULFAMIC
VAR	VARIABLE

EQUIPMENT PROFILE

NAME ________ ALC ________ DATE ________ RCC ________ SHEET 9 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT 1st	2nd	3rd	DOWNTIME PREVENTIVE MAINT. FREQ.	SHIFT	DOWN TIME	UNSCHEDULED BREAKDOWN REPAIR TIME MTBF	MTTR	PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS MIN	MAX	ALTERNATE EQUIPMENT CODE	SOURCE
5601	WARM RINSE CR-43													
6115	ALKA CLEAN CR-44													
6111	COLD RINSE CR-45													
5805	DEOXIDIZE CR-46													
5629	COLD RINSE CR-47													
6112	NITR ACID CR-48													
5630	COLD RINSE CR-49													
5607	ZINCATE CR-50													
5605	WARM RINSE CR-51 (Empty)													
5631	COLD RINSE CR-53													
5606	HOT RINSE CR-54													

LSC-20094B

2.2 EQUIPMENT

The equipment used in MANPRC for wear coating by plating (brush and tank-type) is very conventional, using well-established equipment requirements. The equipment for ion-vapor deposition is rather sophisticated but is well-known and fully-developed. Ancillary operations relative to plating/metal washing are the grit-blast and shot-peen operations and the

EQUIP[illegible] PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 6 OF ___

EQUI. MENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
C053	WAX TANK													
5685	WATERTANK													
5596	CHR PLATE CR-3												5635 5597 5636 5639 5637 5640 5638 5641	5642
5635	CHR PLATE CR-4												5596 5597 5636 5639 5637 5640 5638 5641	5642
5636	CHR PLATE CR-5												5635 5597 5596 5639 5637 5640 5638 5641	5642
5637	CHR PLATE CR-6												5635 5597 5596 5639 5636 5640 5638 5641	5642
5638	CHR PLATE CR-7												5635 5597 5596 5639 5636 5640 5637 5641	5642
5597	CHR PLATE CR-12												5635 5638 5596 5639 5636 5640 5637 5641	5642
5639	CHR PLATE CR-13												5635 5638 5596 5597 5636 5640 5637 5641	5642
5640	CHR PLATE CR-14												5635 5638 5596 5597 5636 5639 5637 5641	5642
5641	CHR PLATE CR-15												5635 5638 5596 5597 5636 5639 5637 5640	5642
5642	CHR PLATE CR-16												5635 5638 5596 5597 5636 5639 5637 5640	5641

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 7 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5646	CHR PLATE CR-26												5645 5598 5644 5648 5643 5649	[illegible]
5645	CHR PLATE CR-25												5646 5598 5644 5648 5643 5649	
5644	CHR PLATE CR-24												5646 5598 5645 5648 5643 5649	
5643	CHR PLATE CR-23												5646 5598 5645 5648 5644 5649	
5598	CHR PLATE CR-22												5646 5643 5645 5648 5644 5649	
5650	CHR PLATE CR-34													
5607	COLD RINSE CR-8													
5655	HOT RINSE CR-11													
5800	COLD RINSE CR-17													
5636	RUST STRP CR-18													
5601	RUST STRP CR-19													
5603	FS RINSE CR-30 (Ferrous Sulfate)													

EQUIPM PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 8 OF ____

EQUI. MENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT 1st	2nd	3rd	DOWNTIME PREVENTIVE MAINT. FREQ.	SHIFT	DOWN TIME	UNSCHEDULED BREAKDOWN REPAIR TIME MTBF	MTTR	PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS MIN	MAX	ALTERNATE EQUIPMENT CODE	SOURCE
6113	COLDRINSE CR-27													
5624	COLDRINSE CR-28													
2625	HOT RINSE CR-29													
6114	HOT RINSE CR-31													
	CHR PLATE CR-34												5596 5645 5643 5646 5644 5648	5649
5648	CHR PLATE CR35												5596 5645 5643 5646 5644 5649	
5649	CHR PLATE CR-36												5596 5645 5643 5646 5644 5648	
5626	COLDRINSE CR-37													
5604	CR-38 (EMPTY)													
5599	VAPOR DEG CR-39													
5803	CHRSTRP A CR-41													
5627	COLDRINSE													

LSC-2009-1B

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 10 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT 1st	2nd	3rd	DOWNTIME: PREVENTIVE MAINT. FREQ.	SHIFT	DOWN TIME	UNSCHEDULED BREAKDOWN REPAIR TIME: MTBF	MTTR	PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS MIN / MAX	ALTERNATE EQUIPMENT CODE	SOURCE
5808	CHRSTRP_S CR-61												
5809	CHRSTRP_S CR-56												
5810	CHRSTRP_S CR-57												
5811	COLDRINSE CR-58												
5812	HOT_RINSE CR-59												
5637	CAD__STRP CR-60												
5607	HYDRCACID CR-75												
5818	HOT_RINSE CR-79												
5833	CAD__STRP CA-1												
5826	FORMULA_P CA-2 (EMPTY)												
5827	FORMULA_P CA-3												
5812	COLDRINSE CA-4												

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 11 OF ____

EQUI. MENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3d	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5626	HOT RINSE CA-5													
5622	IRIDLIE CA-6													
5613	COLDRINSE CA-7													
5631	CYANIDACI CA-9													
5619	VAPOR DEG CA-12													
5634	HOT RINSE CA-13													
5635	CHR ACID CA-14													
5613	COLDRINSE CA-15 [illegible]													
5636	CAD HOLD CA-16													
5837	CAD PLATE CA-17													
5838	CAD PLATE CA-18													

LSC-2009-IB

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 12 OF ___

EQUI. MENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME: PREVENTIVE MAINT.			DOWNTIME: UNSCHEDULED BREAKDOWN REPAIR TIME		PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5817	RUST STRP CR-73 (EMPTY)													
5608	VAPOR DEG CR-72													
5840	COLD RINSE CA-28													
5839	FORMULA P CA-27													
5620	VAPOR DEG CA-25													
5842	CR-37 EMPTY													
5846	NI PLATE CA-38 (Watts)													

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 13 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT 1st	2nd	3rd	DOWNTIME PREVENTIVE MAINT. FREQ.	SHIFT	DOWN TIME	UNSCHEDULED BREAKDOWN REPAIR TIME MTBF	MTTR	PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS MIN / MAX	ALTERNATE EQUIPMENT CODE	SOURCE
5847	COLDRINSE CA-39												
5848	SULF ACID CA-40												
5849	NI PLATE CA-41 (Sulfamate)												
5850	NI PLATE (Sulfamate) CA-42 EMPTY												
5851	SULFMACID CA-43												
5852	TIN PLATE (Alkaline) CA-44												
5853	CHR ACID (Seal) CA-45											5854	
5854	NI STRP CA-46											5853	
5855	PHOSPHATE (LUBRITE #2) CA-47												
0249	VAPOR DEG AN-3												
5681	CLN TURCO AN-4												
5693	FORM P-R AN-5												

LSC-2009-1B

EQUIPMENT PROFILE

NAME ________ ALC ________ DATE ________ RCC ________ SHEET 14 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5670	COLD RINSE AN-6													
5656	NITR ACID AN-7 EMPTY?													
5671	COLD RINSE AN-8													
5679	ANOD STRP AN-9													
5707	DEOXIDIZE AN-10													
5698	COLD RINSE AN-11 EMPTY													
CHR Anodize Type II AN-12B 5714	CHR ANOD (Type I) AN-12A													
5699	COLD RINSE AN-13													
5678	SEAL (Nickel Acetate) AN-14													
5676	HOT RINSE AN-15													
5700	COLD RINSE AN-16													
5613	ANOD SEAL (Sodium Dichromate) AN-17													

EQUIPM OFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 15 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT 1st	2nd	3rd	DOWNTIME PREVENTIVE MAINT. FREQ.	SHIFT	DOWN TIME	UNSCHEDULED BREAKDOWN REPAIR TIME MTBF	MTTR	PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS MIN	MAX	ALTERNATE EQUIPMENT CODE	SOURCE
5701	COLDRINSE AN-18													
5709	SULF_ANOD AN-20													
5702	COLDRINSE AN-19													
5717	SULF_ANOD AN-2[illegible]													
5703	COLDRINSE AN-22													
5712	HARD_ANOD AN-23												6100	
6100	HARD_ANOD AN-24												5712	
5695	VAPOR_DEG AN-25													
5691	CLN_TURCO AN2[illegible]													
5692	FORM_P-R AN-28													
5704	COLDRINSE AN-29													
5857	PASSIVATE Type II AN-30													

USC-2009 IB

EQUIPME[illegible]ROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 16 OF ___

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5705	COLDRINSE AN-31													
5680	ANOD STRP AN-32													
5708	DEOXIDIZE AN-33													
5706	COLDRINSE AN-34													
5672	ALODINE AN-35													
5656	HOT RINSE AN-36													
5677	HOT RINSE AN-39													
5663	COLDRINSE AN-40													
5674	ANOD SEAL AN-41													
5664	COLDRINSE AN-42													
5716	SULF ANOD AN-43													
5665	COLDRINSE AN-44													

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 17 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5715	SULF ANOD AN-45													
5666	COLDRINSE AN-46													
5713	SULF ANOD AN-47													
5882	OIL SEAL AN-50													
5881	OIL SEAL AN-51													
5877	CHR ACID AN-52													
5694	PHOS Z AN-53													
5630	COLDRINSE AN-54													
5675	MANG PHOS AN-55													
5660	HOT RINSE AN-56													
5696	BLACK DYE AN-57													
5668	COLDRINSE AN-58													

EQUIPMENT PROFILE

NAME ____ ALC ____ DATE ____ RCC ____ SHEET 18 OF ____

EQUI. MENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5697	RED DYE AN-59													
5861	COLDRINSE AN-60													
5661	NEUTRALIZ AN-61													
5862	HOT RINSE AN-62													
5829	HOT RINSE AN-63													
6101	FORMULA P CA-51													
5614	COLDRINSE CA-52													
5864	COLDRINSE CA-53													
5865	COLDRINSE CA-54													
5615	COLDRINSE CA-55													
5866	HYDROACID (20%) CA-56													
5867	COLDRINSE CA-57													

EQUIPME PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 19 OF ____

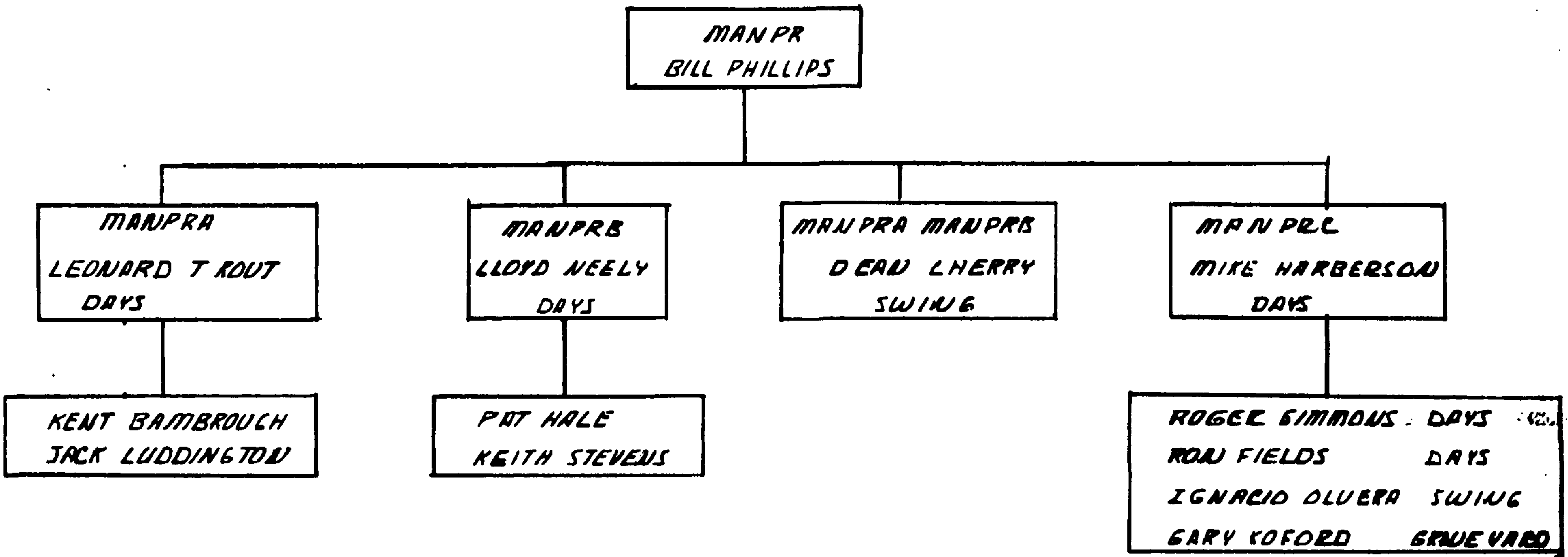
EQUI. MENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5616	COLDRINSE CA-58													
5666	CAD PLATE CA-59													
5617	COLDRINSE CA-60													
5618	COLDRINSE CA-61													
5832	CHR ACID CA-62													
5878	COLDRINSE CA-63													
5621	HOT RINSE CA-64													
5870	HOT RINSE CA-65													
5869	SILY STRP SI-1													
5662	COLDRINSE SI-2													
5876	ALKACLEAN SI-3													
5659	COLDRINSE SI-4													

EQUIPMENT PROFILE

NAME ______ ALC ______ DATE ______ RCC ______ SHEET 20 OF ____

EQUIPMENT CODE	EQUIPMENT TYPE/DESCRIPTION	QUANTITY PER SHIFT			DOWNTIME					PERCENT USED FOR OTHER RCCs (e.g. TIME NOT AVAILABLE)	ENVELOP UNITS		ALTERNATE EQUIPMENT CODE	SOURCE
					PREVENTIVE MAINT.			UNSCHEDULED BREAKDOWN REPAIR TIME						
		1st	2nd	3rd	FREQ.	SHIFT	DOWN TIME	MTBF	MTTR		MIN	MAX		
5872	SULE ACID SI-5													
5661	COLDRINSE SI-6													
5873	COP STRIK SI-7													
5660	COLDRINSE SI-8													
5880	NI STRP SI-9													
5811	COLDRINSE SI-10													
5875	SILVSTRIK SI-11													
5874	SILVPLATE SI-12													
5879	WARMRINSE SI-13													
5658	HOT RINSE SI-14													

LSC-2009-1B


MANPR
BILL PHILLIPS
MANPRA
LEONARD TROUT
DAYS
KENT BAMBROUCH
JACK LUDDINGTON
MANPRB
LLOYD NEELY
DAYS
PAT HALE
KEITH STEVENS
MANPRA MANPRB
DEAN CHERRY
SWING
MANPRC
MIKE HARBERSON
DAYS
ROGER SIMMONS DAYS
RON FIELDS DAYS
IGNACIO OLVERA SWING
GARY KOFORD GRAVEYARD

MANPOWER FILE

NAME [redacted] FLETCHER ALC OO-ALC DATE 17MAY89 RCC MANPRC SHEET ___ OF ___

SKILL CODE/LEVEL	JOB DESCRIPTION	QUARTER	QUANTITY AVAILABLE									MANPOWER AVAILABLE (HOURS)									ALTERNATE SKILL CODE/LEVEL
			WORK WEEK			WEEKEND			HOLIDAYS			WORK WEEK			WEEKEND			HOLIDAYS			
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
UP05	FORKLIFT	1 FY 88-3		1																	UP06 ~~UP08~~ UP09
		2 88-4		1									5.6								
		3 89-1	1										5.6								
		4 89-2	2	1								5.6									
UP06	JR JOURN BAKE OPERATORS MISC ITEMS	1	5	2	1							5.6	5.6								~~UP07~~ [illegible]
		2	5	2	1							5.6	5.6	5.6							
		3	5	2	1																
		4	5	2	1																
UP08	BST JOURN ALL BLASTERS JOURNEYMAN JR JOURNEYMAN NOT TRAINEES	1	3		2																[illegible]
		2	3		7																
		3	3	2	2																
		4	3	2	2																
UP09	PLT JOURN ALL PLATERS JOURNEYMAN JR JOURNEYMAN NOT TRAINEES	1	16	1	9																UP06
		2	16	11	9																
		3	16	10	9																
		4	16	10	9																
		1																			
		2																			
		3																			
		4																			

MANPRC PLATING SHOP
27 AUG - 23 SEP 89

MICHAEL F. HARBERTSON, MACH GEN FRMN — JOANN, MARBLE ELTRPLTR TRG

##

ANODIZE-CAD PLATE (17)

SIMMONS, ROGER (S)	WS-09
CISOWSKI, DAN	WG-09
COPENHAVER, D. (A)	WG-09
DRAKE, DELL	WG-09
FRITZ, ROBERT	WG-09
MARONEY, LONNIE	WG-09
NEWTON, RICHARD	WG-09
PIERCE, THOMAS	WG-07
RIVERA, GREG	WG-09
SMUIN, STEPHEN	WG-09
VALDEZ, JOSEPH	WG-07
VILLARRRUEL, CATHY	WG5P7
WIGGINS, STEVEN	WG-09

PUMPERS — DAYS

EVERETT, MICHAEL	WG5P7
GREENWOOD, BRENT	WG-07
HAYBALL, JAN	WG-07
KITE, AMY	WG5P7

CHROME/IRRIDITE/
BRUSH PLATE (17) DAYS

FIELDS, RONDAL (S)	WS-09
BAKER, DEAN	WG-07
BILLMIRE, SHARON	WG-09
DODSON, JOANN	WG5P7
EGGLESTON, DALLAS	WG-09
HANSEN, GERALD	WG-09
HOLMES, GORDON	WG-09
JACOBSEN, LESLIE	WG-07
LARSON, DAVID	WG-09
ROYLANCE, GREG (A)	WG-09
SMITH, HARRY	WG-09

SHOT PEEN — DAYS

ACKER, LESLIE	WG5P8
MARTIN, DAVID	WG-08
MILLETT, W.(US)(LO)	WG-08
SANCHEZ, MANUEL	WG5P8
SEIFERT, JACK	WG-08
VELASQUEZ, LEE	WG-08

CHROME/VAC/wCAD/
BAKE: (17) SWING

OLVERA, IGNACIO (S)	WS-09
BURKDOLL, JAMES	WG-09
FRANCIS, WADE S.	WG-07
GALLEGOS, DAN	WG-09
HALL, MIKE	WG-09
HYER, STEVEN	WG-09
LICHT, SUSAN	WG-09
MAKI, JAMES	WG-09
MCATEE, JAMES (A)	WG-09
PERKINS, RANDY	WG-09
SHAW, LAWRENCE	WG-09
SMITH, BRENT	WG-09
SMITH, BRUCE	WG-09
STEWART, JEFFREY	WG-09

CHROME/ANODIZE
CAD/BAKE (13) GRAVE

KOFORD, GARY (S)	WS-09
BRADLEY, RICHARD	WG-09
CHAVEZ, JESUS	WG-09
FIELD, ROBERT	WG-09
NELSON, DALE	WG-09
NICKERSON, AMY	WG-09
PLAYER, MARLIN (A)	WG-09
SMITH, WILFORD	WG-09
SWANER, STEVEN	WG-07
THORNLEY, MARK	WG-09
WAYMAN, WILLIAM	WG-09

SHOTPEEN — GRAVE

FACER, ROBERT	WG-08
NICHOLLS, RODNEY	WG-08

SHOTPEEN — SWING

KELLER, EDWARD	WG-08
ROBBINS, MARK	WG-08

PSU — DAYS

BODILY, LOY	WG-05

(S) - SUPERVISOR
(A) - ALTERNATE
(LI) - LOANED IN
(LO) - LOANED OUT
(US) - UNION STEWARD
* - ON CALL

PRC ASSIGNED:

3711-WS-12	1
3711-WS-09	4
3711-WL-08	1
3711-WG-09	37
3711-WG-07	6
3711-WG-05	2
3769-WG-08	8
3769-WG-05	2
4749-WG-07	2
4749-WG-05	2
6910-WG-05	1

TOTAL: 65

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT DATE 08-13-89 A-G0370-G81-D2-M08 PG 488

RCC: MANPRC FOREMAN CODE:

<------CURRENT ASSIGNMENT------>								<------LOAN STATUS INFORMATION------>										
EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-M
FIELDS RON	408622832	C	21		1	1												
KOFORD GARY L	528544357	C	21		1	3												
OLVERA IGNACIO Z	317828161	C	21		1	2												
SIMMONS ROGER A	528705888	C	21		1	1												

DUTY CODE TOTALS:	PERSONNEL ASSIGNED	4
	PERSONNEL BORROWED	0
	PERSONNEL LOANED	0
	NET STRENGTH	4
F/C TOTAL:	NET STRENGTH	4

RCC: MANPRC FOREMAN CODE: C1

<-----------------CURRENT ASSIGNMENT-----------------> <----------------------LOAN STATUS INFORMATION---------------------->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
ACKER LESLIE M	516641041	C	11	UP	1	1												
BAKER DEAN A	528687255	C	11	UP	1	1												
BILLMIRE SHARON L	529828166	C	11	UP	1	1												
DODSON JOANN	529827935	C	11	UP	1	1												
EGGLESTON DALLAS	529668363	C	11	UP	1	1												
HANSEN GERALD M	528441626	C	11	UP	1	1												
HOLMES GORDON J	529484755	C	11	UP	1	1												
JACOBSEN LESLIE J	529131166	C	11	UP	1	1												
LARSON DAVID W	528626101	C	11	UP	1	1	89											
ROYLANCE GREGORY	529669859	C	11	UP	1	1												
SANCHEZ MANUEL	529700477	C	11	UP	1	1												
SEIFERT JACK T	528589474	C	11	UP	1	1												
SMITH HARRY E	528668205	C	11	UP	1	1												
VELASQUEZ LEE I	528604020	C	11	UP	1	1												

DUTY CODE TOTALS:	PERSONNEL ASSIGNED	14
	PERSONNEL BORROWED	0
	PERSONNEL LOANED	0
	NET STRENGTH	14
F/C TOTAL:	NET STRENGTH	14

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT DATE 08-13-89 A-G037G-G61-D2-MG6 PG 490

RCC: MANPRC FOREMAN CODE: C2

<-----------------CURRENT ASSIGNMENT----------------> <---------------------LOAN STATUS INFORMATION---------------------->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
COPENHAVER DENNIS	184349805	C	11	UP	1	1												
DRAKE DELL R	529585983	C	11	UP	1	1												
EVERETT MICHEAL	528841957	C	11	UP	1	1												
FRITZ ROBERT P	390607087	C	11	UP	1	1												
GREENWOOD BRENT	528620704	C	11	UP	1	1												
HAYBALL JAN W	528721140	C	11	UP	1	1												
NEWTON RICHARD L	507665609	C	11	UP	1	1												
PIERCE THOMAS G	528266244	C	11	UP	1	1												
RIVERA GREG H	528888102	C	11	UP	1	1												
SMUIN STEPHEN R	528862620	C	11	UP	1	1												
VALDEZ JOSEPH D	528747336	C	11	UP	1	1												
VILLARRUEL CATHY	528909551	C	11	UP	1	1												
WIGGINS STEVE J	529708828	C	11	UP	1	1												

DUTY CODE TOTALS:	PERSONNEL ASSIGNED	13
	PERSONNEL BORROWED	0
	PERSONNEL LOANED	0
	NET STRENGTH	13
F/C TOTAL:	NET STRENGTH	13

5

RCC: MANPRC FOREMAN CODE: C3

<-----------------CURRENT ASSIGNMENT----------------> <---------------------LOAN STATUS INFORMATION--------------------->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
BODILY LOY R	529606156	C	11	UP	1	2												
BURKDOLL JAMES K	529608652	C	11	UP	1	2												
FRANCIS WADE	528117035	C	11	UP	1	2												
GALLEGOS DANIEL	529600837	C	11	UP	1	2												
HALL MICHAEL R	519449535	C	11	UP	1	2												
HYER STEVEN K	529663417	C	11	UP	1	2												
KELLER EDWARD A	359383464	C	11	UP	1	2												
LICHT SUSAN	528784109	C	11	UP	1	2												
MAKI JAMES M	528689503	C	11	UP	1	2												
MARONEY LONNIE R	528880841	C	11	UP	1	2												
MARTIN DAVID W	263707399	C	11	UP	1	1												
MCATEE JAMES M	528542611	C	11	UP	1	2												
PERKINS RANDY S	528866453	C	11	UP	1	2												
ROBBINS MARK E	529944590	C	11	UP	1	2												
SHAW LAWRENCE B	528889790	C	11	UP	1	2												
SMITH BRENT L	529841153	C	11	UP	1	2												
SMITH BRUCE L	529841201	C	11	UP	1	2												
STEWART JEFFREY E	528880994	C	11	UP	1	2												

DUTY CODE TOTALS:	PERSONNEL ASSIGNED	18
	PERSONNEL BORROWED	0
	PERSONNEL LOANED	0
	NET STRENGTH	18
F/C TOTAL:	NET STRENGTH	18

5

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT DATE 08-13-89 A-G037G-G61-D2-MG6 PG 492

RCC: MANPRC FOREMAN CODE: C4

<------------------CURRENT ASSIGNMENT-----------------> <-----------------------LOAN STATUS INFORMATION----------------------->

EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
BRADLEY RICHARD M	529138905	C	11	UP	1	3												
CHAVEZ JESUS V	553669834	C	11	UP	1	3												
FACER ROBERT N	528887519	C	11	UP	1	3												
FIELD ROBERT K	528640616	C	11	UP	1	3												
NELSON DALE B	529627076	C	11	UP	1	3												
NICHOLLS RODNEY B	529564893	C	11	UP	1	3												
NICKERSON AMY J	529782937	C	11	UP	1	3												
PLAYER MARLIN W	529606423	C	11	UP	1	3												
SMITH WILFORD D	529583585	C	11	UP	1	3												
SWANNER STEVEN	528784691	C	11	UP	1	3												
THORNLEY MARK R	529700745	C	11	UP	1	3												
WAYMAN WILLIAM	284225851	C	11	UP	1	3												

DUTY CODE TOTALS:	PERSONNEL ASSIGNED	12
	PERSONNEL BORROWED	0
	PERSONNEL LOANED	0
	NET STRENGTH	12
F/C TOTAL:	NET STRENGTH	12

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT DATE 08-13-89 A-G037G-G61-D2-MG8 PG 493

RCC: MANPRC FOREMAN CODE: C5

<------CURRENT ASSIGNMENT------>								<------LOAN STATUS INFORMATION------>										
EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
CISOWSKI DANIEL	529625859	C	11	UP	1	1												
MARBLE JOSEPHINE	255542490	C	11	UP	1	1												

DUTY CODE TOTALS:

PERSONNEL ASSIGNED	2
PERSONNEL BORROWED	0
PERSONNEL LOANED	0
NET STRENGTH	2

F/C TOTAL: NET STRENGTH 2

PERSONAL DATA - PRIVACY ACT OF 1974 (PL93-579) FOR OFFICIAL USE ONLY

ACFCM (2) MANPRC (2) RCC TOTAL LABOR ASSIGNMENT REPORT DATE 08-13-89 A-G037G-G61-D2-MG6 PG 494

RCC: MANPRC FOREMAN CODE: RC

<------CURRENT ASSIGNMENT------>								<------LOAN STATUS INFORMATION------>										
EMPLOYEE NAME	IDENT	MC	DC	SK	DO	SH	SP	STATUS	RCC	DC	SK	DO	FC	SH	SP	EFF DATE	TERM DATE	J-O-N
KITE AMY R	828180108	C	11	UP	1	1												

DUTY CODE TOTALS:	PERSONNEL ASSIGNED	1
	PERSONNEL BORROWED	0
	PERSONNEL LOANED	0
	NET STRENGTH	1
F/C TOTAL:	NET STRENGTH	1
RCC TOTAL:	NET STRENGTH	64

9

[redacted] June 5, 1989

MARK SAID THAT THIS IS MEANT TO BE A SHORT TERM QUICK FIX. HE WOULD LIKE TO EVENTUALLY REPLACE PM 303 VAPOR DEGREASER WITH A WARM DETERGENT WASH AND CLEAN RINSE. HOWEVER THIS IS OVER A YEAR AWAY.

BOB BISHOFF ASKED HOW MANY PEOPLE RON FIELDS HAS IN PLATING?

RON TOLD ME

5 ON First
5 ON SECOND
5 ON THIRD

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OGDEN AIR LOGISTICS CENTER (AFLC)
HILL AIR FORCE BASE, UTAH 84056

REPLY TO ATTN OF: MAW

AUG 2 1988

SUBJECT: FY89 Approved Resource Control Center (RCC) Rates

TO: MAB MAK MAN MAQ MAR MAS

1. The attached list of FY89 RCC rates has been approved by Headquarters AFLC/MAJ and will be used in the G004L system for pricing all temporary work orders.

2. These rates may be used in estimating the cost of new requirements. An actual bill of material (BOM) may be used for direct expense material instead of the rate; this will provide more equitable pricing. Other direct costs for temporary travel duty (TDY) will have to be added to obtain the total cost.

3. Any questions relating to these rates should be directed to Mrs Daphne Gale, MAWFB, extension 72452/3.

THOMAS H. BROWNING
Dep Ch, Resources Management Division
Directorate of Maintenance

1 Atch
FY89 RCC Rates

UNITED STATES AIR FORCE
SEPTEMBER 18, 1947

FY89 APPROVED RATES

RCC		DIRECT LABOR	OPER OVHD	GEN & ADMIN	TOTAL BASE RT	DIR MATRL	TOTAL RATE
MBPAA	:	$18.93	$12.69	$8.32	$39.94	$10.88	$50.82
MBPAB	:	$18.78	$13.05	$8.32	$40.15	$11.18	$51.33
MBPAC	:	$18.97	$12.88	$8.32	$40.17	$11.79	$51.96
MBPAE	:	$19.51	$12.46	$8.32	$40.29	$0.00	$40.29
MBPAH	:	$18.93	$13.03	$8.32	$40.28	$14.81	$55.09
MBPAS	:	$19.11	$13.12	$8.32	$40.55	$0.00	$40.55
MBPBC	:	$18.05	$13.50	$8.32	$39.87	$3.80	$43.67
MBPDA	:	$20.75	$14.96	$8.30	$44.01	$1.79	$45.80
MBPDB	:	$21.40	$16.90	$8.30	$46.60	$1.39	$47.99
MBPDC	:	$20.82	$10.99	$8.00	$39.81	$1.33	$41.14
MBPMA	:	$0.00	$5.07	$5.29	$10.36	$5.31	$15.67
MBPMB	:	$0.00	$8.28	$8.32	$16.60	$5.92	$22.52
MBPMC	:	$0.00	$22.97	$9.94	$32.91	$0.00	$32.91
MBPSA	:	$17.43	$10.48	$7.86	$35.77	$0.00	$35.77
MBPSB	:	$16.64	$11.16	$8.14	$35.94	$0.00	$35.94
MBPSC	:	$18.47	$10.70	$8.14	$37.31	$0.00	$37.31
MBPSD	:	$19.97	$14.60	$7.86	$42.43	$0.00	$42.43
MBPSE	:	$18.18	$18.00	$7.93	$44.11	$0.00	$44.11
MBPSK	:	$17.16	$10.64	$7.93	$35.73	$0.00	$35.73
MBPSM	:	$16.99	$10.50	$7.93	$35.42	$0.00	$35.42
MBPSP	:	$20.43	$10.96	$7.93	$39.32	$0.00	$39.32
MBPSS	:	$17.99	$11.21	$7.93	$37.13	$0.00	$37.13
MKLAA	:	$19.73	$11.17	$8.24	$39.14	$2.91	$42.05
MKLBB	:	$19.26	$27.71	$8.24	$55.21	$0.00	$55.21
MKLCC	:	$20.65	$9.65	$8.24	$38.54	$3.63	$42.17
MKLDD	:	$19.38	$47.26	$8.23	$74.87	$0.00	$74.87
MKLEE	:	$19.59	$12.42	$8.24	$40.25	$6.06	$46.31
MKLFF	:	$18.90	$15.18	$8.24	$42.32	$8.25	$50.57
MKLGG	:	$20.49	$26.70	$8.24	$55.43	$0.00	$55.43
MKPAA	:	$19.20	$20.28	$8.23	$47.71	$2.11	$49.82
MKPAC	:	$19.30	$21.03	$8.32	$48.65	$8.05	$56.70
MKPCA	:	$18.85	$28.60	$8.30	$55.75	$13.51	$69.26
MKPCD	:	$20.40	$48.25	$8.28	$76.93	$10.51	$87.44
MKPCF	:	$18.81	$26.05	$8.27	$53.13	$18.91	$72.04
MKPDA	:	$2.16	$7.10	$8.22	$17.48	$3.00	$20.48
MKPDB	:	$19.44	$5.50	$8.15	$33.09	$0.00	$33.09
MKPEA	:	$19.00	$12.84	$8.24	$40.08	$10.81	$50.89
MKPEB	:	$18.60	$12.40	$8.24	$39.24	$3.86	$43.10
MKPGB	:	$20.91	$6.98	$8.08	$35.97	$0.09	$36.06
MKPIA	:	$19.63	$26.12	$8.31	$54.06	$9.08	$63.14
MKPIB	:	$18.84	$13.76	$8.31	$40.91	$26.82	$67.73
MKPIC	:	$19.79	$10.91	$8.23	$38.93	$6.87	$45.80
MKPKA	:	$19.40	$43.39	$8.31	$71.10	$17.36	$88.46
MKPKB	:	$19.79	$10.91	$8.23	$38.93	$6.87	$45.80
MKPKE	:	$21.01	$38.43	$8.29	$67.73	$19.18	$86.91

MKPNC	:	$19.40	$43.39	$8.31	$71.10	$17.36	$88.46
MKPND	:	$20.06	$13.03	$8.32	$41.41	$9.83	$51.24
MKPNE	:	$19.49	$12.06	$8.31	$39.86	$25.70	$65.56
MKPNN	:	$20.23	$16.82	$8.23	$45.28	$27.77	$73.05
MKPPP	:	$20.06	$30.41	$13.24	$63.71	$0.00	$63.71
MKPRA	:	$19.49	$12.06	$11.57	$43.12	$31.50	$74.62
MKPRF	:	$17.30	$11.74	$8.32	$37.36	$9.49	$46.85
MKPRS	:	$20.23	$16.82	$8.24	$45.29	$8.50	$53.79
MKPRW	:	$19.24	$15.10	$7.88	$42.22	$21.00	$63.22
MKPWA	:	$17.54	$24.70	$8.03	$50.27	$0.00	$50.27
MKPWB	:	$17.54	$24.70	$8.03	$50.27	$0.00	$50.27
MKPWC	:	$17.54	$24.70	$8.03	$50.27	$0.00	$50.27
MKPWD	:	$17.54	$24.70	$8.03	$50.27	$0.00	$50.27
MKPWE	:	$17.54	$24.70	$8.03	$50.27	$0.00	$50.27
MKPWF	:	$17.54	$24.70	$8.03	$50.27	$0.00	$50.27
MNPBA	:	$19.25	$17.07	$8.43	$44.75	$15.99	$60.74
MNPBB	:	$18.58	$14.52	$8.43	$41.53	$19.84	$61.37
MNPCB	:	$17.59	$17.13	$8.22	$42.94	$29.74	$72.68
MNPCD	:	$18.38	$14.36	$8.31	$41.05	$9.40	$50.45
MNPCK	:	$17.76	$16.14	$8.29	$42.19	$13.82	$56.01
MNPCL	:	$17.76	$15.44	$8.25	$41.45	$38.25	$79.70
MNPCR	:	$18.01	$18.71	$8.33	$45.05	$3.22	$48.27
MNPCT	:	$18.23	$15.84	$8.39	$42.46	$14.35	$56.81
MNPGN	:	$18.51	$16.09	$8.37	$42.97	$0.00	$42.97
MNPGP	:	$18.53	$16.04	$8.35	$42.92	$0.37	$43.29
MNPGW	:	$16.90	$22.07	$8.36	$47.33	$0.00	$47.33
MNPME	:	$19.69	$18.11	$8.29	$46.09	$2.29	$48.38
MNPMG	:	$21.50	$25.48	$8.19	$55.17	$3.53	$58.70
MNPMK	:	$19.55	$16.31	$8.36	$44.22	$0.00	$44.22
MNPMN	:	$18.74	$21.05	$8.41	$48.20	$5.56	$53.76
MNPNA	:	$18.51	$16.09	$8.37	$42.97	$0.00	$42.97
MNPRA	:	$17.82	$16.67	$8.28	$42.77	$0.00	$42.77
MNPRB	:	$18.50	$22.46	$8.26	$49.22	$0.00	$49.22
MNPRC	:	$17.97	$22.43	$8.24	$48.64	$0.35	$48.99
MNPSA	:	$17.79	$21.23	$8.42	$47.44	$10.54	$57.98
MNPSE	:	$17.90	$16.46	$8.43	$42.79	$20.16	$62.95
MNPSQ	:	$17.65	$15.23	$8.34	$41.22	$10.35	$51.57
MNPWA	:	$19.59	$14.51	$8.39	$42.49	$0.17	$42.66
MNPWB	:	$23.11	$19.26	$9.63	$52.00	$0.00	$52.00
MNPWE	:	$18.43	$15.75	$8.07	$42.25	$8.09	$50.34
MNPWW	:	$19.13	$16.69	$8.23	$44.05	$3.41	$47.46
MQCCC	:	$22.36	$14.62	$8.14	$45.12	$0.00	$45.12
MQCMM	:	$22.31	$21.57	$8.14	$52.02	$0.00	$52.02
MQQVC	:	$20.72	$11.91	$7.95	$40.58	$0.00	$40.58
MRAEC	:	$28.32	$22.97	$9.94	$61.23	$0.00	$61.23
MRAEE	:	$28.32	$22.97	$9.94	$61.23	$0.00	$61.23
MRAEH	:	$28.32	$22.97	$9.94	$61.23	$0.00	$61.23
MRAEN	:	$28.32	$22.97	$9.94	$61.23	$0.00	$61.23

MSAAA	:	$22.41	$11.12	$8.20	$41.73	$0.52	$42.25
MSABB	:	$23.89	$10.60	$8.20	$42.69	$1.38	$44.07
MSACC	:	$23.06	$9.96	$8.20	$41.22	$0.00	$41.22
MSADD	:	$22.44	$10.79	$8.20	$41.43	$1.60	$43.03
MSFAA	:	$21.36	$12.29	$8.44	$42.09	$0.00	$42.09
MSFBB	:	$17.95	$11.34	$8.44	$37.73	$0.00	$37.73
MSFCC	:	$23.03	$11.06	$8.19	$42.28	$0.00	$42.28
MSFDD	:	$23.03	$11.06	$8.19	$42.28	$0.00	$42.28
MSFEE	:	$21.36	$12.29	$8.44	$42.09	$0.00	$42.09
MSMAA	:	$21.69	$12.29	$8.20	$42.18	$1.29	$43.47
MSMBB	:	$22.44	$10.79	$8.20	$41.43	$1.60	$43.03
MSMCC	:	$23.03	$11.06	$8.19	$42.28	$0.00	$42.28

RCC/MANPRC REPAIR PROCESS ASSESSMENT

The function of the RCC is to provide support relative to the application of corrosion-resistant coatings, engineering-type metallic coatings for wear-resistance and finally, coatings to metal surfaces to provide improved adhesion of organic coatings to various aircraft landing-gear parts for both repair and re-manufacture purposes. The major operations performed in the RCC are: 1) anodizing and chromate conversion coating of aluminum and phosphatizing of ferrous metals to provide both adhesion of organic coatings and corrosion resistance; 2) application of hard chromium electrodeposits to high-strength steel bearing and journal surfaces for wear-resistance; 3) application of electrodeposits of cadmium, nickel and silver to various metallic substrates for both corrosion-resistance and engineering requirements and finally; 4) Ion-vapor deposition (IVD) of aluminum for improved corrosion resistance as a substitute for toxic cadmium deposits and meeting all stringent environmental concerns. In addition, an up-to-date brush-plating facility functions for the application of metallic coatings and the anodizing of aluminum to selected, localised areas on both disassembled parts in the RCC confines and also on assembled parts on functional aircraft while in a hangar-facility or on the flight-line tarmac.

The processes used to perform the noted operations are generally consistent with established private industry and with AF T.O. 42C2-1-7 and are adequately maintained by the Process Control Laboratory in conjunction with the RCC supervision. The masking of parts prior to metal finishing utilizing a hot-melt plastic (cellulose acetate butyrate) has been strongly recommended to be substituted with a hot-melt wax material with very significant economic and processing advantages as reported in Task Order No. 7 (Phase I) Contract Summary Report and Quick Fix Plan (Revision A) dated 18 May 198[illegible]. Two Quick Fix opportunities have been submitted per the Task Order No. 1 RCC Assessment relative to the existing use of the hot-melt plastic maskant. The RCC also utilizes two chemical solutions not found in T.O. 42C2-1-7 with one of which (Formula "P-R"), used for the alkaline (etch) cleaning of aluminum alloys only by RCC/MANPRC instead of the authorized solution (C-205). The RCC personnel like the results of the alkaline etch cleaner to obtain a very clean aluminum surface quickly and is also simpler to chemically analyse by the Process Control Laboratory. A third Quick Fix opportunity has been submitted detailing the recommendation to utilize a separate Chromic Acid solution (other than the existing procedure using a chrome plating solution) to perform

the reverse-current etching of high-strength steel landing-gear parts immediately prior to chrome plating. While the existing procedure is a significant improvement over the former use of a reverse-current etch in 50% sulfuric acid, the build-up of iron and other alloying elements in the high-strength steel (Alloy 300M could be detrimental to the corrosion-resistance of the hard chromium electrodeposits. McDonnell Aircraft Company (MCAIR) utilizes a separate Chromic Acid/Sulfuric Acid tank similar to the chromium plating tanks for reverse-current etching of the Alloy 300M high-strength steel landing-gear parts to prevent contamination of the chromium plating tanks. MAHPRC does use industry-preferred reversible-rect. 2 bus bar system to deposit thick deposits of chromium efficiently and without trivalent chromium problems (often associated with the old 3-bus bar configuration) with the use of the preferred non-fluoride catalyst or mixed-catalyst type or solution formulation (T.O.42C2-1-7/C-407).

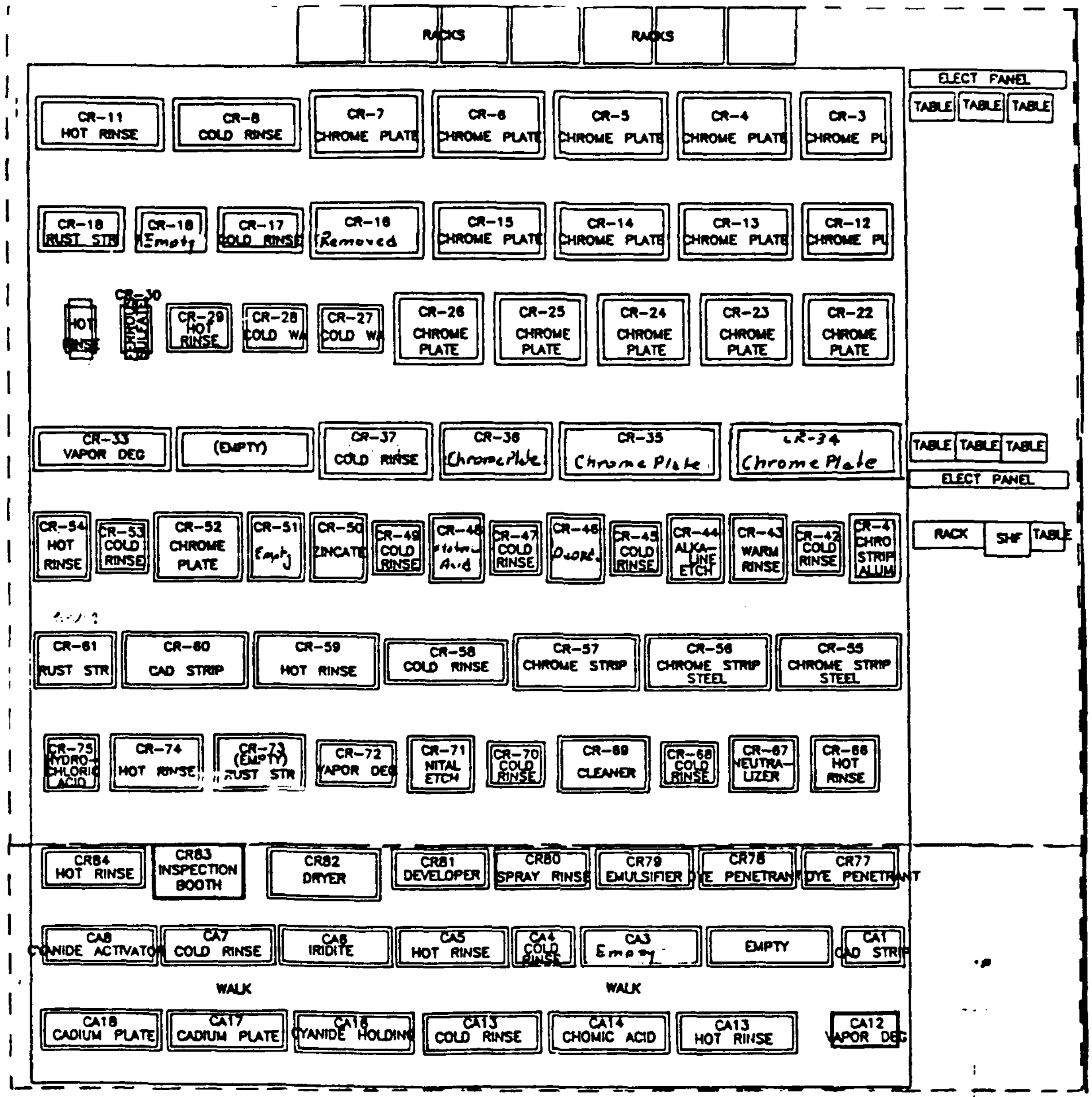
The RCC is staffed with knowledgeable and experienced supervision and mechanics. Closer technical support and involvement with day-to-day problems by both the Process Engineering and Process Control Laboratory personnel would be beneficial. McDonnell Douglas Corp. (MDC) mandates very close

manufacturing process support from not only the ~~manufacturing~~ process and equipment engineers and industrial engineers but also close involvement and cooperation with Quality Engineering laboratory support personnel.

The elimination of vacuum-cadmium deposition system and replacement with ion-vapor deposition (IVD) of aluminum has been a very positive technological and environmentally-acceptable decision by the RCC. Also, the use of the virtually non-toxic 1,1,1-trichloroethane vapor degreasing solvent instead of the rather toxic perchloroethylene solvent in present use by three other Air Logistics Centers (ALC's); i.e. OC-ALC, SA-ALC and SM-ALC eliminates the use of high Volatile Organic Compounds (VOC) recently curtailed to a maximum of 25 ppm by the Environmental Protection Agency (EPA).

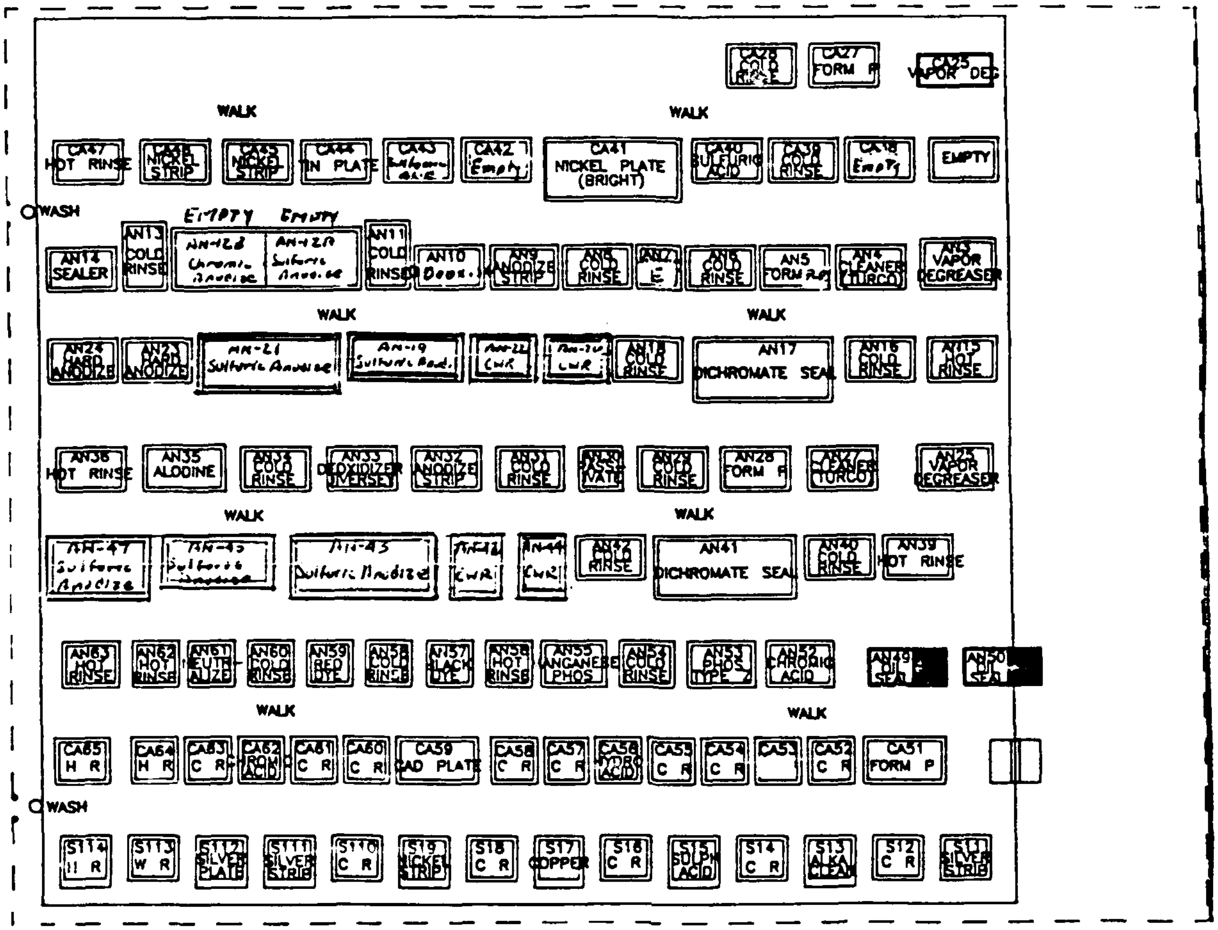
The RCC has very adequate means of oven-baking for both stress-relief of certain parts in addition to hydrogen embrittlement relief consisting of both batch-type ovens and a conveyorized oven-cure utilizing two time-cycle simultaneously. The facilities for both abrasive grit-blasting and shot-blasting to impart compressive-type stress to metal surfaces are more than adequate and are well-maintained.

R. Bostieff - 6/1/89



CONFIGURATION AND CONTENTS OF NORTH WET-CHEMICAL PROCESS TANKS IN BCC/ITANPRC OF OO-ALC

FIGURE I



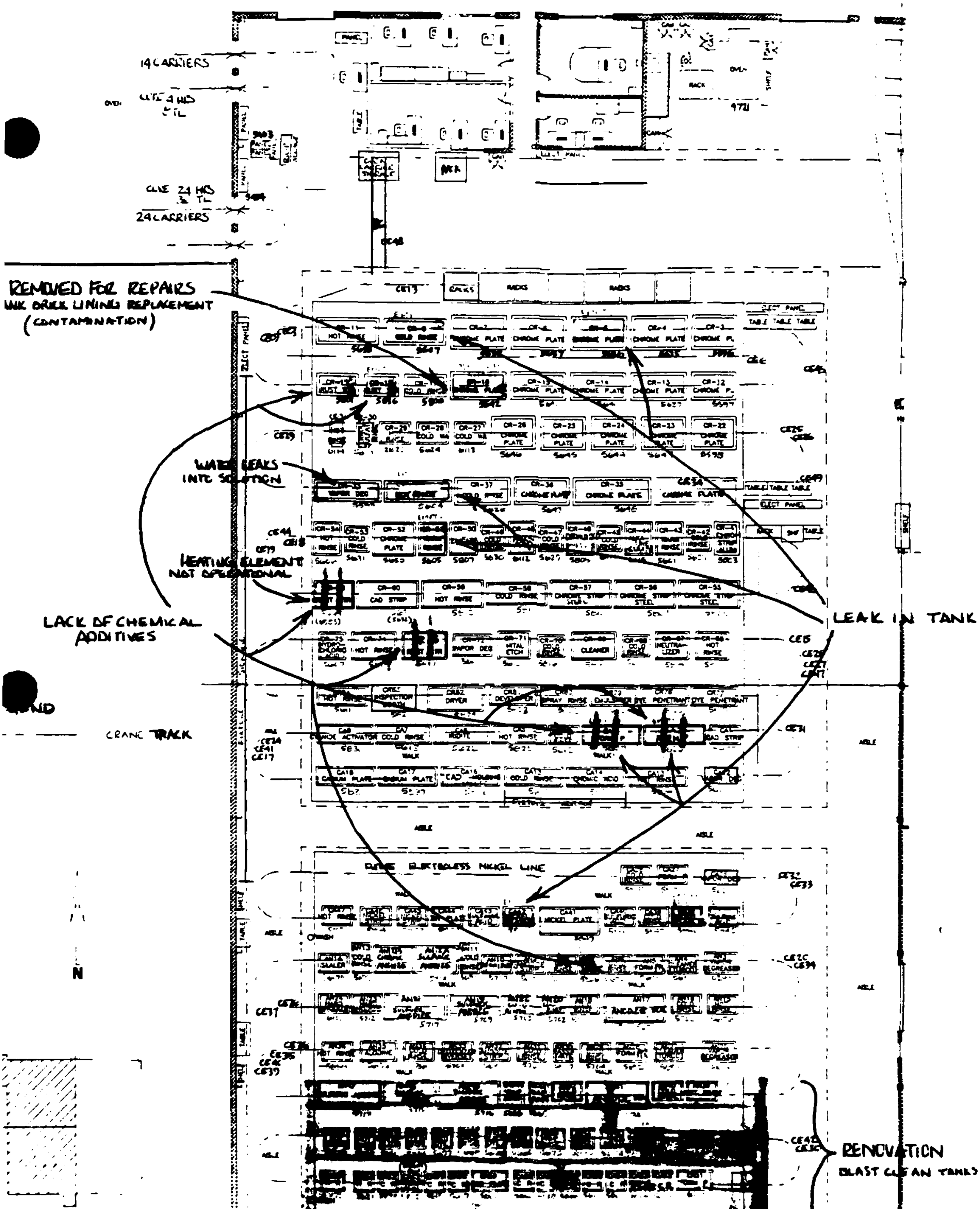
CONFIGURATION AND CONTENTS OF SOUTH WET-CHEMICAL PROCESS TANKS IN RCC/MANPRC OF OO-ALC

FIGURE II

ELECTROLESS NICKEL LINE IS CURRENTLY DONE IN SMALL MAKE SHIFT TANKS/BUCKETS SET INSIDE A TANK TO WARM IT.

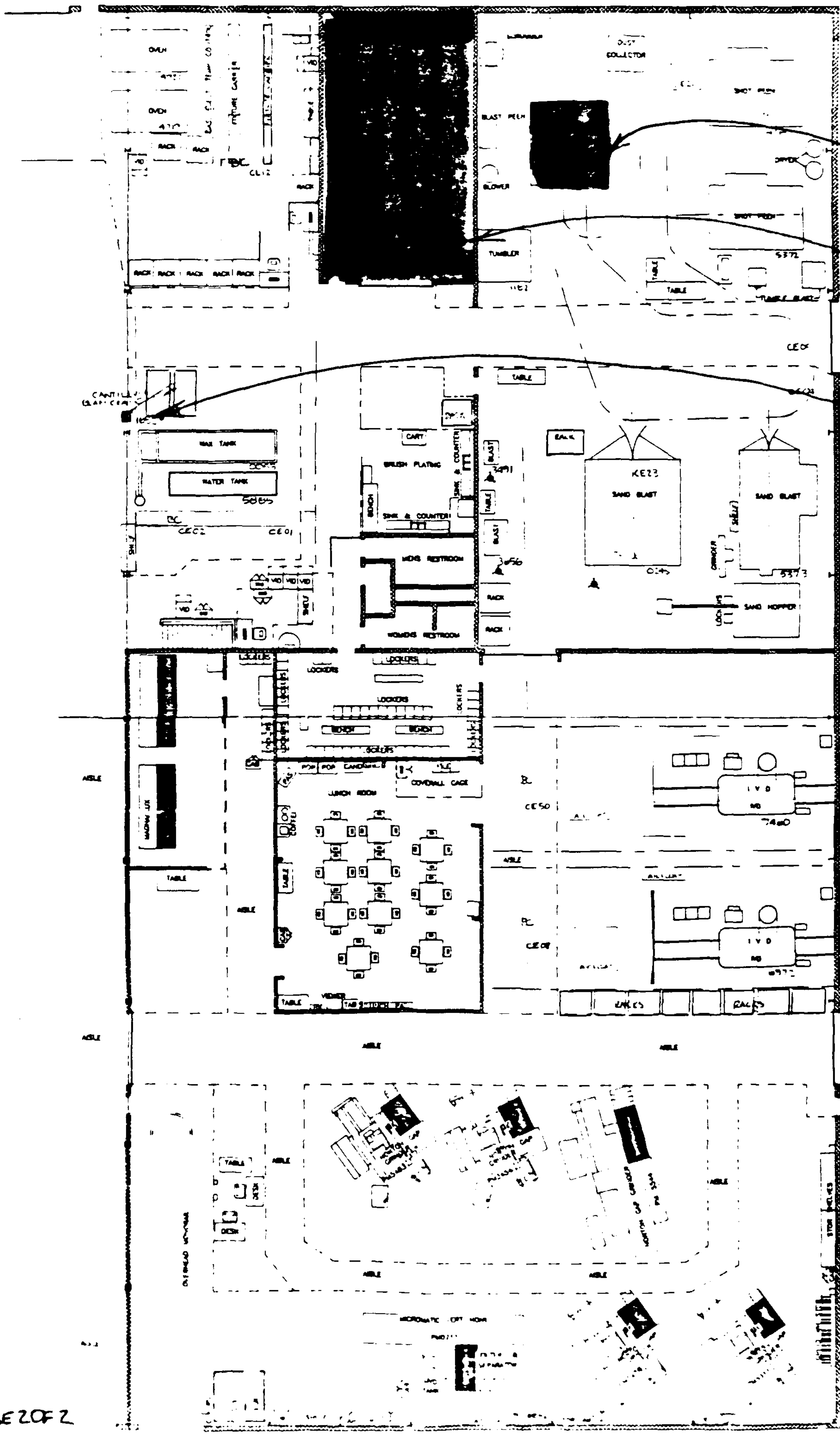
ATTACHED IS A LAYOUT ILLUSTRATING THE VARIOUS REASONS FOR EQUIPMENT BEING DOWN, ALSO A LISTING OF THE CHEMICALS USED IN EACH OF THE PLATING TANKS.

THERE ARE FUTURE PLANS FOR AN ELECTROLESS NICKEL LINE, COPPER LINE, BLACK OXIDE, AND GLASS PEENING, THERE ARE ALSO PLANS TO MOVE THE OFFICES AND LUNCH ROOM TO ANOTHER BUILDING AND USE THE LUNCH ROOM AS STORAGE SPACE, AND THE OFFICE SPACE AS STORAGE SPACE WITH MORE CHROME PLATING TANKS THE AREA WHERE THE VAC CAD IS WILL BE USED FOR FIXTURE OR PART STORAGE. ALL OF THE ABOVE PLANS ARE STILL JUST PLANS AND MIGHT BE CHANGED.



NON OPERATIONAL
EQUIPMENT
LAYOUT

PAGE 1 OF 2



BEING REMOVED
NOT OPERATIONAL

BEING REMOVED
IVD REPLACES PROCESS

NOT FUNCTIONAL
FOR APPLICATION
(CRANE HEIGHT)

The testing frequencies below are for normal usage. Any solution consistently out of tolerance will be analyzed more frequently than listed to insure operation in tolerance. Concentrations listed are as per required specifications, standards, manufacturers' recommendations, or laboratory direction. Test frequency is defined as any time within the calendar period listed and approximately the specified period apart: e.g., once/week will be within the calendar week, not necessarily exactly seven days apart.

PLATING SHOP

	Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
1.	Alkaline Cleaner (CR-44)	Trisodium Phosphate	3.0 - 5.0	4.0	Once/month
		Sodium Carbonate	1.0 - 3.0	2.0	
2.	Alkaline Cleaner (SI-3)	Sodium Hydroxide	8 - 12	10	Once/month
		Trisodium Phosphate ($12\ H_2O$)	11 - 16	13.8	Once/month
3.	Anodize Sealer (AN-17, 41)	Sodium Dichromate ($2\ H_2O$)	5 - 9	7	Once/2 weeks
		pH	5.0 - 6.5	No optimum	Once/2 weeks
4.	Anodize Strip (AN-9, 32)	Chromic Acid	2 - 4	3.0	Once/2 weeks
		Phosphoric Acid	4 - 8	5	Once/2 weeks
		Sulfate	0.11 max		Once/2 weeks
5.	Black Dye	pH	5.8 - 6.0	5.9	As requested
6.	Bright Dip (CA-14, 62)	Chromic Acid	pH 2-4	3.0	Once/month
7.	Cadmium Plate (CA-17, 18, 59)	Cadmium	2.8 - 3.2	3	Once/2 weeks
		Total Sodium Cyanide	12 - 18	16	Once/2 weeks
		Sodium Hydroxide	1.5 - 4	1.8	Once/month
		Sodium Carbonate	0 - 5		Once/year
		Iron	600 ppm max		Once/3 months
		Ratio NaCN/Cd	4 - 6	5	
-	CAD STRIP (CA1, CR60)	AMMONIUM NITRATE			

Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
8. Cad Holding (CA-16)	Sodium Cyanide	8 - 18	14	Once/month
	Sodium Hydroxide	2 - 12	8	Once/month
9. Cyanide Activator (CA-8 , CA-53)	Sodium Cyanide	5 - 8	6.6	Once/month
	Sodium Hydroxide	2 - 4	3	Once/month
10. Chemical Conversion coat for aluminum (AN-35)	Chromic Acid	0.5 - 2.5	1.2	Once/2 weeks
	Potassium Ferro-cyanide, Barium	No Control; Add in proportion	0.36	
	Silico-fluoride	to CrO_3	0.32	
	pH	1.4 - 1.7	1.6	Once/2 weeks
11. Chromic Acid (AN-52)	pH	2 - 4		Once/month
12. Chromium Plate (CR-3, 4, 5, 6, 7, 12, 13, 14, 15, 16, 22, 23 24, 25, 26, 34, 35, 36, 52)	Chromic Acid	30 - 36	33	Once/2 weeks
	Sulfuric Acid	0.30 - 0.36	0.33	Once/2 weeks
	Chromic Acid/ Sulfuric Acid Ratio	80 - 120	100	Once/2 weeks
	Iron	0 - 5 gm/l		Once/year
	Trivalent Chromium	0 - 4 gm/l		Once/year
13. Chromium Strip Acid (Aluminum) CR-41	Sulfuric Acid	150 - 200 gm/l	175 gm/l	Once/month
	Sodium Chloride	0.22 g/l max		Once/3 months
14. Chromium Strip *Caustic* (Steel) (CR-55, 56, 57)	Sodium Hydroxide	9 - 11	10	Once/2 weeks
15. Chromic Acid Anodize (AN-12B)	Chromic Acid	4 - 14	10	Once/month
	pH	Less than 0.85		Once/month
	Sodium Chloride	0.22 g/l max		Once/3 months
	Sulfate	0.53 g/l (0.07 oz/gal) max		Once/month
	Cr^{+3}	4 g/l max		once/year

Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
16. Copper Strike (SI-7)	Copper	3.5 - 4.3	4.0	Once/month
	Rochelle Salt	4 - 8	6	Once/month
	Free Sodium Cyanide	0.2 - 0.5	0.4	Once/month
	Sodium Carbonate	4 - 8		Once/year
17. Deoxidizer (AN-10,33) CR 46	TABCO 9004 ALKALUME DEVORSEY	4 - 12	8	Once/2 weeks
18. Ferrous Sulfate Rinse (CR-30)	pH	2 - 3.5		After solution change (change once/month)
19. Formula P (CA-2, 3, 27, 51)	Sodium Hydroxide	0.5 - 3.0	1.5	Once/2 weeks
	Trisodium Phosphate (dodecahydrate)	4.0 - 12.0	8.0	Once/2 weeks
	Sodium Carbonate	1 - 6	3.5	Once/2 weeks
20. Formula P-R (AN-5, 28)	Rust Stripper	2.0 - 4.0	3.0	Once/2 weeks
	Aluminum	2.5 max		
21. 15% Hydrochloric Acid (CA-56)	Hydrochloric Acid	10 - 20%	15%	Once/month
— 30% HYDROCHLORIC ACID (CR-75)	HYDROCHLORIC ACID			
22. Iridite (CA-6)	Rohdip 218	2 - 3%	2.3%	Monthly
23. Nickel Plate (bright) (CA-38, 42)	Nickel	9 - 12	10.9	Once/month
	Boric Acid	4 - 8	5.5	Once/month
	pH	3.8 - 4.4	4.0	Once/month
	Chloride	1.5 - 3.0	2.4	Once/month
24. Nickel Plate (sulfamate) (CA-41, ~~[illegible]~~)	Nickel	8.0 - 12.0	10.2	Once/2 weeks
	Boric Acid	Check bag	6.0	Once/2 weeks
	pH	3.6 - 4.8	4.5	Once/2 weeks
	Surface tension	Less than 35 dynes/cm		Once/2 weeks
	Sulfate	Less than 0.2		Once/2 weeks
	Hardness ~~[illegible]~~	Greater than Rc 36		Once/year

— NEUTRALIZE (AN-61)

Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
25. Woods Nickel (SI-9)	Nickel	7 - 9	8	Once/month
	Hydrochloric Acid	11 - 19	14	Once/month
– Nickel Sulfamate Acid Pickle Bath (CA-31)	Sulfamic Acid			
– Nickel Strip (CA-45)		25 gal		
– Holding Pump Tank for Nickel Strip (CA-46)				
– Nickel Acetate Sealer (AN-14)	Nickel Acetate			
29. Nitric Acid (50% V/V) (CR-48)	Nitric Acid	55 - 82	62	Once/month
30. Passivate (AN-30, 07)	Sodium Dichromate ($2H_2O$)	2.7 - 4.1	3.4	Once/2 weeks
	Nitric Acid	27 - 34	30.5	Once/2 weeks
31. Phosphatize Manganese (AN-53)	Total Acid (TA)	16 - 21	19.5	As required
	TA/FA Ratio	5.5 - 7.0	6.0	As required
	Iron	0.27 - 0.4	0.3	As required
32. Red Dye (AN-59)	pH	5 - 7	6	As required
33. Rust Stripper (CR-19, 61, CR-16, 73)	Rust Stripper	25 - 32	28	Once/month
34. Silver Plate (SI-12)	Potassium Hydroxide	0 - 4	1	Once/month
	Silver Cyanide	10 - 15	13	Once/month
	Free Potassium Cyanide	7 - 12	10	Once/month
	Potassium Carbonate	2 - 15	2	Once/year

Operation (Tank No)	Chemicals	Operating Limit (oz/gal)	Optimum Concentration (oz/gal)	Testing Frequency
35. Silver Strike (SI-11)	Free Potassium Cyanide	7 - 9	8	Once/month
	Silver Cyanide	0.2 - 0.5	0.3	Once/month
	Potassium Carbonate	6 - 8	6	Once/year
36. Silver Strip (SI-1)	Sodium Cyanide	11 - 13	12	Once/month
	Sodium Hydroxide	1 - 3	2.0	Once/month
37. Sulfuric Acid (CA-40, SI-5)	Sulfuric Acid	5 - 101%	8%	Once/month
38. Sulfuric Anodize Hard (AN-23, 24)	Sulfuric Acid	225 - 270 gm/l	250 gm/l	Once/2 weeks
	Aluminum	20 g/l max		Once/2 weeks
	Oxalic Acid	1.4 - 1.6	1.5	Once/2 weeks
	Sodium Chloride	0.22 g/l max		Once/3 months
39. Sulfuric Anodize Soft (AN-19, 21, 43, 45, 47) AN-12A	Sulfuric Acid	170 - 220 gm/l	195 gm/l	Once/ 2 weeks
	Aluminum	20 g/l max		Once/month
	Sodium Chloride	0.22 g/l max		Once/3 months
40. Sulfamic Acid (CA-43)	Sulfamic Acid	80 - 120 gm/l	100 gm/l	Once/month
41. Tin (CA-44)	Sodium Hydroxide	1 - 2	1.5	Once/month
	Sodium Stannate	8 - 14	12	Once/month
42. Turco 4215S (AN-4, 27)	Turco 4215S	4 - 8	6	Once/month
43. Zincate (CR-50)	Sodium Hydroxide	60 - 70	65	Once/month
	Zinc Oxide	10 - 13	12	Once/month
	Ferric Chloride ($6H_2O$)	No control	0.12	
	Rochelle Salts	Add in proportion to ZnO	1.2	

- OIL SEAL (AN49)
- OIL SEAL (PRESERVATIVE) (AN 50)
- VAPOR DEGREASER (CR 33, CR 72, CA12, CA25, AN 3, AN25)

GRIT BLAST ALUMINUM TITANIUM OXIDE 180 grit
GARNET

PERCENT OF OTHER WORKLOAD FOR RCC
(80/20 LISTING)
RCCs

JOB TYPES	MANPGP	MANPGW	MANPNA	MANPRA	MANPRB	MANPRC	MANPWW
TEMPORARY	13.72	2.35	15.11	1.40	1.05	1.35	1.05
MANUFACTURE	0.00	0.00	0.92	0.00	4.51	2.74	12.50
PDM	1.00	0.00	22.79	0.04	0.07	4.39	22.44
ARMAMENT	0.00	0.23	1.26	0.04	0.03	4.18	2.38
HYDRAULICS	0.00	0.05	7.00	1.11	2.67	3.88	13.99
MISTER	95.28	97.37	52.92	97.41	91.67	85.46	97.64

WORKLOAD

THE LOAD WITHIN MANIPRC CONSISTS OF APPROX. 90% MISTR, 5% PDM, 5% TEMPORARY. All of THE WORK HAS BEEN PREVIOUSLY DISASSEMBLED AND IS READY TO BE CLEANED AND PROCESSED ACCORDINGLY.

FLUCTUATIONS USUALLY OCCUR NEAR THE BEGINNING OF THE QUARTER WITH THIRTY PERCENT OF THE TOTAL WORKLOAD FOR THE QUARTER. FIFTY PERCENT NEAR THE END OF THE QUARTER AND TWENTY PERCENT IN THE MIDDLE OF THE QUARTER. THIS IS DUE TO OTHER AREAS CLEANING UP THEIR INVENTORY LEVEL AND SCHEDULING PUSHING ITEMS THRU. *RS,SB,KF

THE HIGHEST VOLUME ATTAINED IN THIS RCC PER QUARTER IS 170,000 EST. PARTS. THIS NUMBER INCLUDES NUTS/BOLTS. AN ESTIMATE OF LARGE PARTS (NOT INCLUDING NUTS/BOLTS) IS 60,000 TO 70,000 PARTS PER QUARTER. * RS

MANPOWER PROFILE

CODE	DESCRIPTION	COMMENTS
UP05	FORKLIFT DRIVER (MATERIAL HANDLER)	ALTERNATES ; UP06, UP08, UP09 (CAN USE PALET JACKS, FORKLIFTS)
UP06	JR JOUNEYMAN (BAKE OPERATERS ONLY)	ALTERNATES : UP09
UP08	BLASTER JOURNEYMAN	NO ALTERNATES BLASTING EQUIPMENT OPERATORS INCLUDES ALL BLASTER JOURNEYMAN AND JR. JOURNEYMAN
UP09	PLATER JOURNEYMAN	ALTERNATES UP06 PLATING EQUIPMENT OPERATORS INCLUDES ALL PLATING JOURNEYMAN AND JR JOURNEYMAN EXCEPT BAKE OPERATORS

ASSUMPTIONS:

- PUMP TECHNICIANS, TRAINIES, AND FOREMAN ARE NOT INCLUDED BECAUSE THEY DO NOT WORK DIRECTLY ON THE PART, UNLESS ACCOMPANIED BY OTHERS.
- ALL UP06, UP08, UP09 ARE QUALIFIED TO OPERATE FORKLIFTS OR ~~A~~ QUALIFIED OPERATOR TEMPORARILY SWITCHES JOBS WITH THE UNQUALIFIED OPERATOR
- ALL UP06 ARE JR JOURNEYMAN ON ALL PLATING OPERATIONS TO BE AN ALTERNATE PLATER
- ALL UP09 ARE QUALIFIED FOR EVERY PLATING PROCESS

WORKFORCE

THE ~~PBN~~ PRC HAS 64 DIRECT LABORORS AND NO INDIRECT AS OF 7 MAY 1989. THE BREAKDOWN IS AS FOLLOWS

# EMPLOYEES	SKILL LEVEL/CODE	WORKSTATIONS QUALIFIED FOR	EXPERIENCE AVG. YRS.
1	WG05/6910	FORKLIFT	3
6	WG05/3711	TRAINING ("GOFER")	1
2	WG17/4749	RMP (TECHNICIAN)	5
8	WG07/3711	ASSOCIATE JOURNEYMAN	4
7	WG08/3769	JOURNEYMAN BLAST	9
34	WG09/3711	JOURNEYMAN ALL BUT BLAST	11
6	WS09/3711	FOREMAN, TRAINER	16
64			

ALL ASSOCIATE JOURNEYMAN REQUIRE JOURNEYMAN SUPERVISION. BUT CAN WORK THEIR WORK STATION ALONE WITH JOURNEYMAN APPROVING THEIR WORK. TWO ASSOCIATE JOURNEYMAN ARE ~~ONLY~~ BEING TRAINED ONLY ON BLAST AREA. THE OTHER FIVE ARE BEING TRAINED ON EVERYTHING BUT BLAST AREA.

CURRENTLY THERE ARE THREE FORKLIFT DRIVERS, TWO ON DAY SHIFT AND ONE ON SWING SHIFT. THERE ARE ___ EMPLOYEES THAT ARE ALSO CROSSTRAINED TO RUN FORKLIFTS WHEN NECESSARY.

TRAINER'S "GOFER" DO VARIOUS ODD JOBS IE., REMOVEING MASKING, MOVING PARTS, RINSING AND DEGREASING, SETUP OF FIXTURES, ETC..

OVERALL ~~THE~~ EACH OF THE INDIVIDUAL WORKERS HAVE AN ADEQUETE OUTLOOK/ATTITUDE OF THEIR JOBS. SOME HATE WHAT THEY DO AND COMPLAIN ABOUT WORK CONDITIONS BUT VERY FEW OF THEM. THE WORK ENVIRONMENT IS THEIR BIGGEST COMPLAINT IE., THE HEAT, AND SMELL. THERE IS A FEAR FOR SAFETY WITH ALL THE CHEMICALS THAT ARE USED IN THE BUILDING. BECAUSE OF THIS FEAR AND WORKERS COMPLAINING IN PUBLIC, THE PLATING SHOP WORKERS JOB IS NOT A "MUCH SOUGHT AFTER POSITION" WITH OTHER RCC EMPLOYEES IN THIS ALC.

REPAIR SUPPORT

MANPRC PLATING SHOP
7 MAY - 3 JUN 89

—IGNACIO Z. OLVERA, MACH GEN FRMN — DAN CISOWSKI, ELTRPLTR TRG

****

ANODIZE-CAD PLATE (18) PUMPERS DAYS

****

—— FIELDS, RONDAL (S) -WS-09
BEENS, JACQUELINE WG5P7
COPENHAVER, D. (A) WG-09
DRAKE, DELL WG-09
EVERETT, MICHAEL WG5P7 -
FRITZ, ROBERT - WG-07 -
GALLEGOS, DAN WG-09
MARONEY, LONNIE WG-09
MARBLE, JOSEPHINE WG-09
NEWTON, RICHARD WG-09
PIERCE, THOMAS - WG-07 -
RIVERA, GREG WG-09
SMUIN, STEPHEN WG-09
VALDEZ, JOSEPH - WG-07 -
VILLARRUEL, CATHY WG5P7 -
WIGGINS, STEVEN WG-09

GREENWOOD, BRENT - WG-07 -
HAYBALL, JAN - WG-07 -

	D	S	G	TL
05 TRAN	6	—	—	6
05 FORK	—	1	—	1
07 JJ	5	1	2	8
07 PUMP	2	—	—	2
08 BLST	3	2	2	7
09 PLT	15	9	10	34
09 SUPR	4	1	1	6
TL	35	14	15	64

CHROME/VAC/CAD/
BAKE (16) SWING
****
SIMMONS, ROGER (S) - WS-09
BURKDOLL, JAMES WG-09
FRANCIS, WADE S. - WG-07 -
HALL, MIKE WG-09
HYER, STEVEN - WG-07 -
LICHT, SUSAN WG-09
MAKI, JAMES WG-09
MCATEE, JAMES (A) WG-09
PERKINS, RANDY WG-09
SHAW, LAWRENCE WG-09
SMITH, BRENT WG-09
SMITH, BRUCE WG-09
STEWART, JEFFREY WG-09

SHOTPEEN SWING
****
KELLER, EDWARD WG-08 -
ROBBINS, MARK WG-08 -

PSU SWING
****
BODILY, LOY — WG-05 —

CHROME/ANODIZE
CAD/BAKE (13) GRAVE
****
KOFORD, GARY (S) - WS-09
BRADLEY, RICHARD WG-09
CHAVEZ, JESUS WG-09
FIELD, ROBERT WG-09
NELSON, DALE WG-09
NICKERSON, AMY WG-09
PLAYER, MARLIN (A) WG-09
SMITH, WILFORD WG-09
SWANER, STEVEN WG-07 -
THORNLEY, MARK WG-09
WAYMAN, WILLIAM WG-09

SHOTPEEN GRAVE
****
PACER, ROBERT WG-08 -
NICHOLLS, RODNEY WG-08 -

~~LARSON, DAVID (LO) WG-09~~ -

CHROME/IRRIDITE/
BRUSH PLATE (16) DAYS
****
BILLMIRE, SHARON (S) WS-09
BAKER, DEAN - WG-07 -
DODSON, JOANN - WG5P7 -
EGGLESTON, DALLAS WG-09
HANSEN, GERALD WG-09
HOLMES, GORDON WG-09
JACOBSEN, LESLIE WG-07 -
LARSON, DAVID WG-09
ROYLANCE, GREG (A) WG-09
SMITH, HARRY WG-09

SHOT PEEN DAYS
****
ACKER, LESLIE - WG5P8 -
MARTIN, DAVID WG-08 -
SANCHEZ, MANUEL - WG5P8 -
SEIFERT, JACK WG-08 -
VELASQUEZ, LEE WG-08 -

~~MILLETT, W. (US)(LO) WG-08~~ -

(S) - SUPERVISOR
(A) - ALTERNATE
(LI) - LOANED IN
(LO) - LOANED OUT
(US) - UNION STEWARD
\# - ON CALL

PRC ASSIGNED:
3711-WS-09 - 4
3711-WG-09 - 34
3769-WG-08 - 10 (1LO)
3711-WG-07 - 11
4749-WG-07 - 3
6910-WG-05 - 1

TOTALS: 63 (1LO)

Yellow = DAYS
Green = SWING
Blue = MIDNIGHT

MATERIAL HANDLING

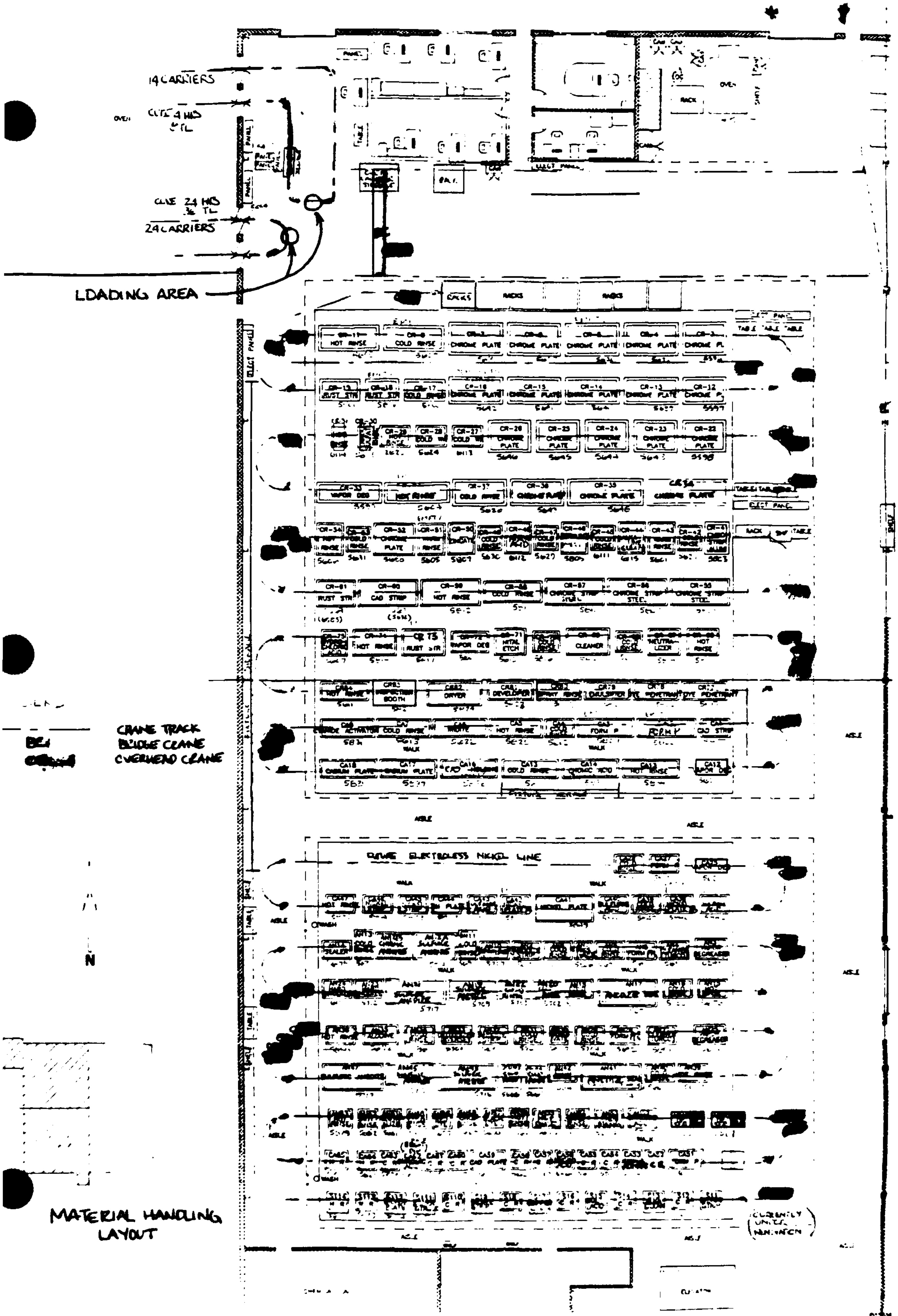
THE MAJORITY OF THE MATERIAL IS MOVED BY FORTY FIVE OVERHEAD CRANES (SIX ON THE FIVE INDIVIDUAL BRIDGE CRANES), OPERATED FROM A NETWORK OF TRACKS ILLUSTRATED ON DRAWING, BY A FORKLIFT MOVING PALLETS OF WORK, MANUALLY, FORTEEN CARRIERS ON THE FOUR HOUR CONTINUOUS CONVEYOR OVEN, ~~AND~~ TWENTY-FOUR CARRIERS ON TWENTY-FOUR HOUR CONTINOUS CONVEYOR OVEN, AND A CANTILEVER BEAM CRANE.

THE EQUIPMENT THAT IS SELDOM EVER USED IS: THE CANTILEVER BEAM CRANE, THE OVERHEAD CRANE "CE 13", THE BRIDGE CRANES OVER THE IVD EQUIPMENT, AND NEXT TO THE OFFICES. THIS IS BECAUSE THERE ARE BETTER WAYS TO MOVE PARTS IE., FORKLIFT.

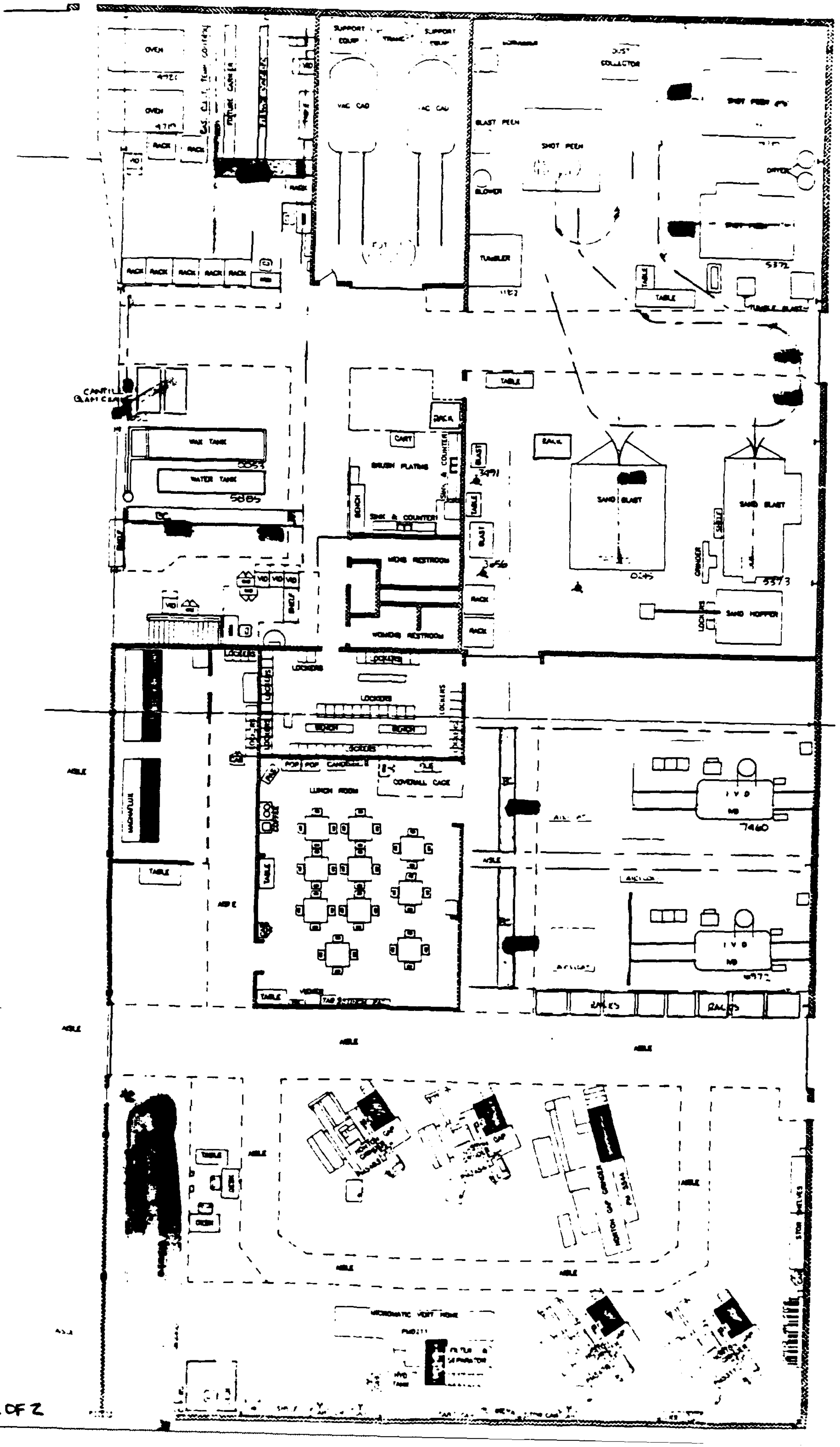
SEVENTY FIVE PERCENT OF THE MATERIAL FLOW IN & OUT OF THE BLDG IS THRU THE NORTH CENTRAL DOOR DOCKING AREA AND PERFORMED BY ANOTHER DEPARTMENTS FORKLIFT AND TRAILER OPERATORS. THE TRAILER IS LEFT OUTSIDE THE DOOR AND LOADED/UNLOADED BY MANPRC FORKLIFT OPERATERS AND MOVED TO A ~~TEMPORARY~~ STAGING AREA INSIDE BUILDING. THAN MOVED TO THE NEXT WORK STATION DEPENDING ON WORK PRIORITY AND QUEING EMPTY SPACE. THE OTHER TWENTY FIVE PERCENT COMES FROM THE OVERHEAD MONORAIL SYSTEM (USUALLY THE LARGER PARTS) AND MOVED TO A TEMPORARY STAGING AREA OR TO THE NEXT WORK STATION DEPENDING ON THE WORK PRIORITY AND QUEING EMPTY SPACE, OCCASIONALLY THE EXTERIOR DOOR TO THE BLAST AREA IS USED TO MOVE MATERIAL IN/OUT OF BUILDING.

THE EQUIPMENT IS GENERALLY IN GOOD CONDITION EXCEPT FOR THE FORKLIFTS. THEY USUALLY END UP BORROWING FROM OTHER DEPARTMENTS.

IT WAS SUGGESTED IN A MEETING WITH SEVERAL (FOREMAN & LEAD JOURNEYMAN) MANUFACTURING PERSONNEL TO BUILD SOME WAY TO MOVE THE PARTS WITHOUT DISCONNECTING THEM FROM MONORAIL LOOP TO MONORAIL LOOP. ANAN SHAH IS MAKING PLANS TO CONNECT THE LOOPS AND ADD AN EXTRA RAIL EVERYWHERE POSSIBLE FOR STORAGE. THIS SYSTEM WILL BE CONNECTED WITH ROPE CONTROL DERAILERS.



MATERIAL HANDLING
LAYOUT



OVEN
OVEN
RACK
RACK
SUPPORT EQUIP
SUPPORT EQUIP
VAC CAD
VAC CAD
DUST COLLECTOR
BLAST PEEN
SHOT PEEN
BLOWER
DRYER
TUMBLER
TABLE
TABLE
TUMBLE BLAST
WAX TANK
WATER TANK
CART
BRUSH PLATING
SINK & COUNTER
BENCH
BLAST
TABLE
SAND BLAST
SAND BLAST
GRINDER
SAND HOPPER
MENS RESTROOM
WOMENS RESTROOM
LOCKERS
LOCKERS
LOCKERS
BENCH
BENCH
POP
POP
COVERALL CAGE
LUNCH ROOM
TABLE
MAGNAFLUX
AISLE
IVD
IVD
RACKS
RACKS
NORTON GAP GRINDER
MICROMATIC VERT HONE
FILTER & SEPARATOR
STOR SHELVES

STORAGE

THERE ARE SEVERAL TYPES OF WORK STORAGE REQUIREMENTS (1) STORAGE AREA OF PARTS WAITING FOR REWORK DISPOSITION; (2) QUEING AREA FOR WORK: BEING WORKED ON, SETUP TO BE WORKED ON, OR NEXT IN LINE TO BE WORKED ON (WIP); (3) STAGING AREA FOR ANY WORK NOT COVERED BY PREVIOUS CATAGORIES.

THE CURRENT SITUATION IS THE WORK IS STORED NEAR THE ENTRANCE WHEREVER THERE IS SPACE OR AS CLOSE TO THE NEXT OPERATION WHEREVER THERE IS SPACE. THIS TYPE OF INVENTORY AND STORAGE SYSTEM TENDS TO NATURALLY VIOLATE THE "FIRST IN/FIRST OUT" RULE CAUSING WORK TO THE SIT IN STORAGE FOR LONG PERIODS OF TIME. *RG,RF

THE RACKS ALONG THE NORTH END OF THE BUILDING ARE FOR STORAGE OF WORK REQUIRING REWORK DISPOSITION, BUT THE RACKS ARE CURRENTLY FILLED TO CAPACITY WITH REWORK AND WIP FROM OTHER RCC'S (PHA PR3, TEMPORARY PRE WORK, ETC). THERE ARE 5 PALLET SIZED SHELVES PER RACK.

FIXTURE STORAGE IS CURRENTLY FILLED TO CAPACITY BUT THERE ARE PLANS TO MAKE THE VAC CAD ROOM A FIXTURE STORAGE/PART STORAGE ANNEX.

THEY ARE ALSO MAKING PLANS TO CREATE MORE STAGING AREA BY DISMANTLING OFFICE & LUNCH ROOM SPACE (IN DISTANT FUTURE). THIS SPACE WILL ALSO BE USED FOR ADDITIONAL PLATING LINES. *RS,RF

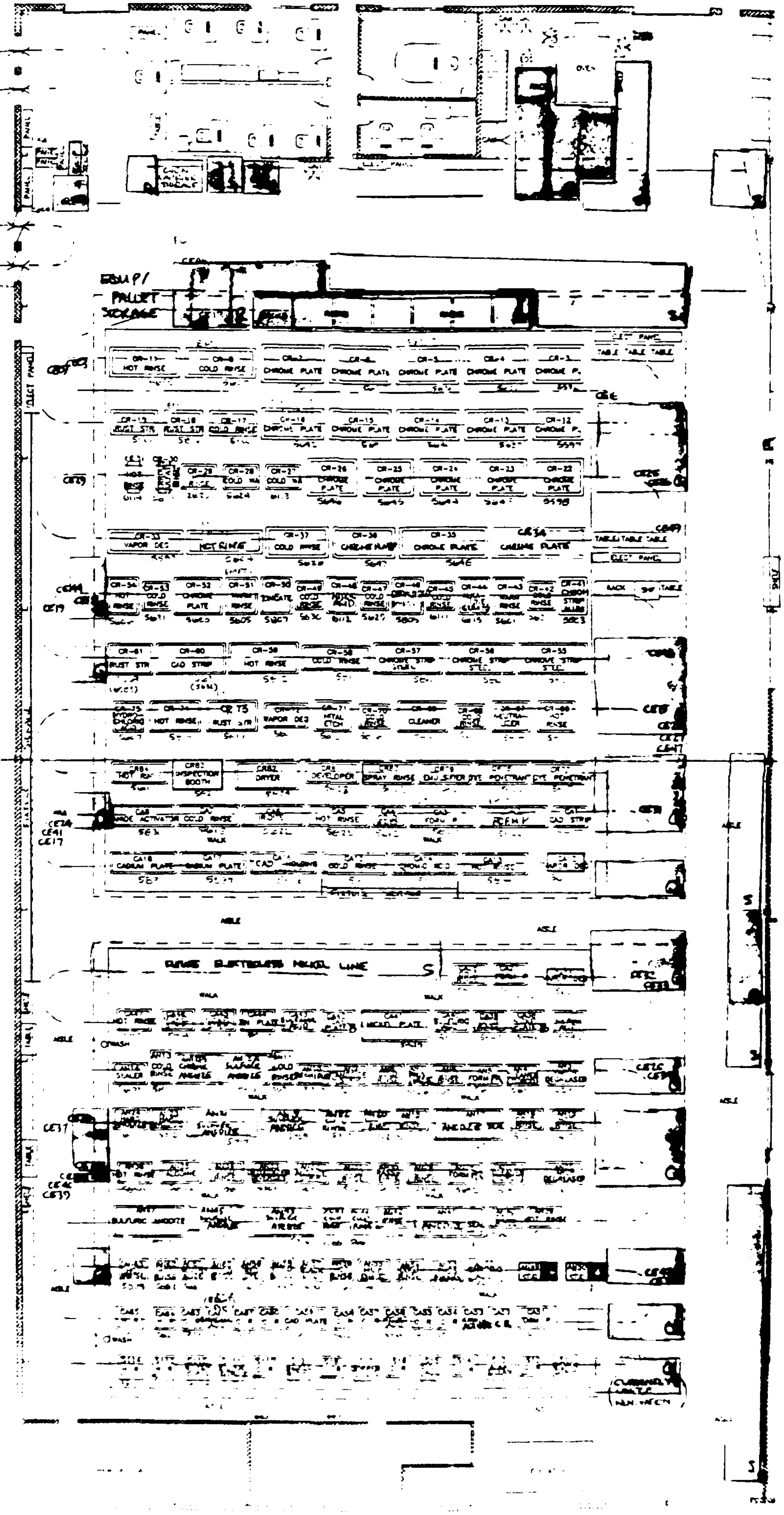
THE GENERAL AREAS FOR STORAGE ARE HIGHLIGHTED IN LAYOUT.

IN A MEETING WITH MANUFACTURING PERSONNEL IT WAS SUGGESTED TO MAKE A ~~MONORAIL~~ MORE STORAGE ~~SYSTEM~~. ANAN SHAH IS PLANNING TO DO THIS WITH A MONORAIL STORAGE SYSTEM, WHERE PARTS ARE HUNG WITH FIXTURE ON MONORAILS BETWEEN LOOPS AND IN CURRENT LUNCH ROOM. ~~IT~~ THIS LUNCH ROOM MIGHT STORE MORE IF IT HAS DIFFERENT LEVEL. HOWEVER THIS PLAN REQUIRES MORE FIXTURING AND A METHOD OF GETTING TO PARTS WITHOUT MOVING ALL THE PARTS ON THE MONORAIL LINE (EASY ACCESS TO STORED PARTS ANYWHERE ON THE SYSTEM)

14 CARRIERS

CLOSE 24 HRS 3x TL

24 CARRIERS

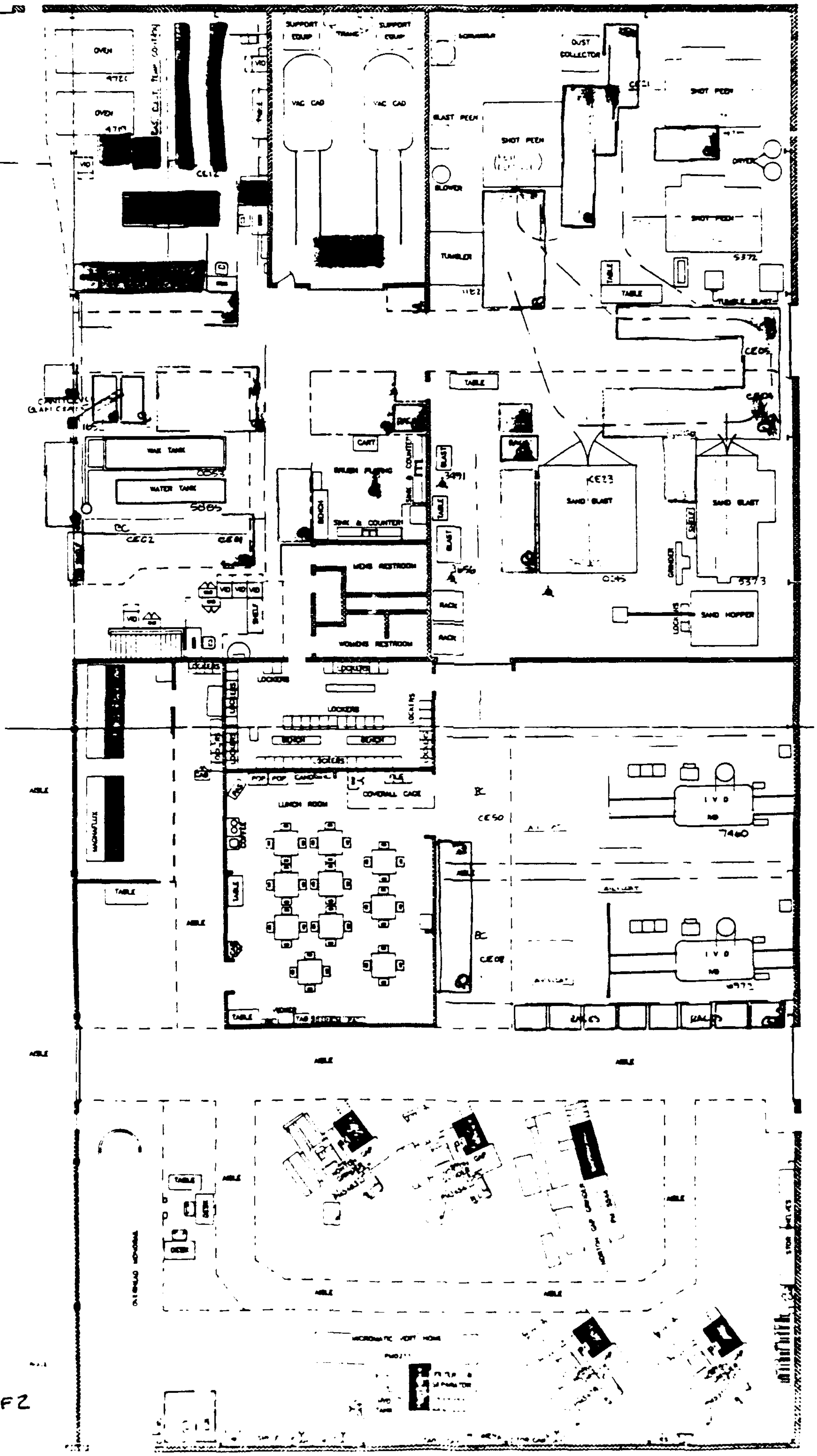


CRANE TRACK
FIXTURE PALLET
R REWORK PALLET
Q QUEING PALLET
S STAGING PALLET

N

STORAGE LAYOUT

PAGE 1 OF 2


OVEN
OVEN
SUPPORT EQUIP
SUPPORT EQUIP
VAC CAD
VAC CAD
DUST COLLECTOR
SHOT PEEN
SHOT PEEN
SHOT PEEN
BLAST PEEN
BLOWER
TUMBLER
DRYER
TABLE
WAX TANK
WATER TANK
BRUSH PLATING
SINK & COUNTER
BENCH
CART
CE23
SAND BLAST
SAND BLAST
SHELF
GRINDER
SAND HOPPER
LOCKERS
MENS RESTROOM
WOMENS RESTROOM
RACK
LOCKERS
BENCH
LUNCH ROOM
COVERALL CAGE
MAGNAFLUX
AISLE
I V D
7460
COFFEE
DESK
OVERHEAD MONORAIL
MICROMATIC HORT HONE

PAGE 2 OF 2

2.8 PROCESS FLOW CHARTS

Aluminum Conversion Process

" Anodize Process

" Anodize Strip Process

Cadmium Plating of High-Strength Landing Gear Parts

LHE (Low Hydrogen Embrittlement) Cadmium Plating Process

Cadmium Stripping Process

Chromium Stripping Process

Chromium Plating Process

Nickel Plating Process

Silver Plating Process

Tin Plating Process

Passivation (of Stainless Steels) Process

Phosphate Coating Process (on Ferrous Metals)

AUXILIARY OPERATIONS

↓

VAPOR DEGREASE
1,1,1-trichloroethane

↓

ALKALI CLEANER
sodium hydroxide
sodium metasilicate
trisodium phosphate
water

↓

RINSE
water (room temperature)

↓

DESMUT
nitric acid
water

↓

RINSE
water (room temperature)

↓

CONVERSION COAT
chromium trioxide
potassium ferrocyanide
barium silicofluoride
water

↓

RINSE
water (room temperature)

↓

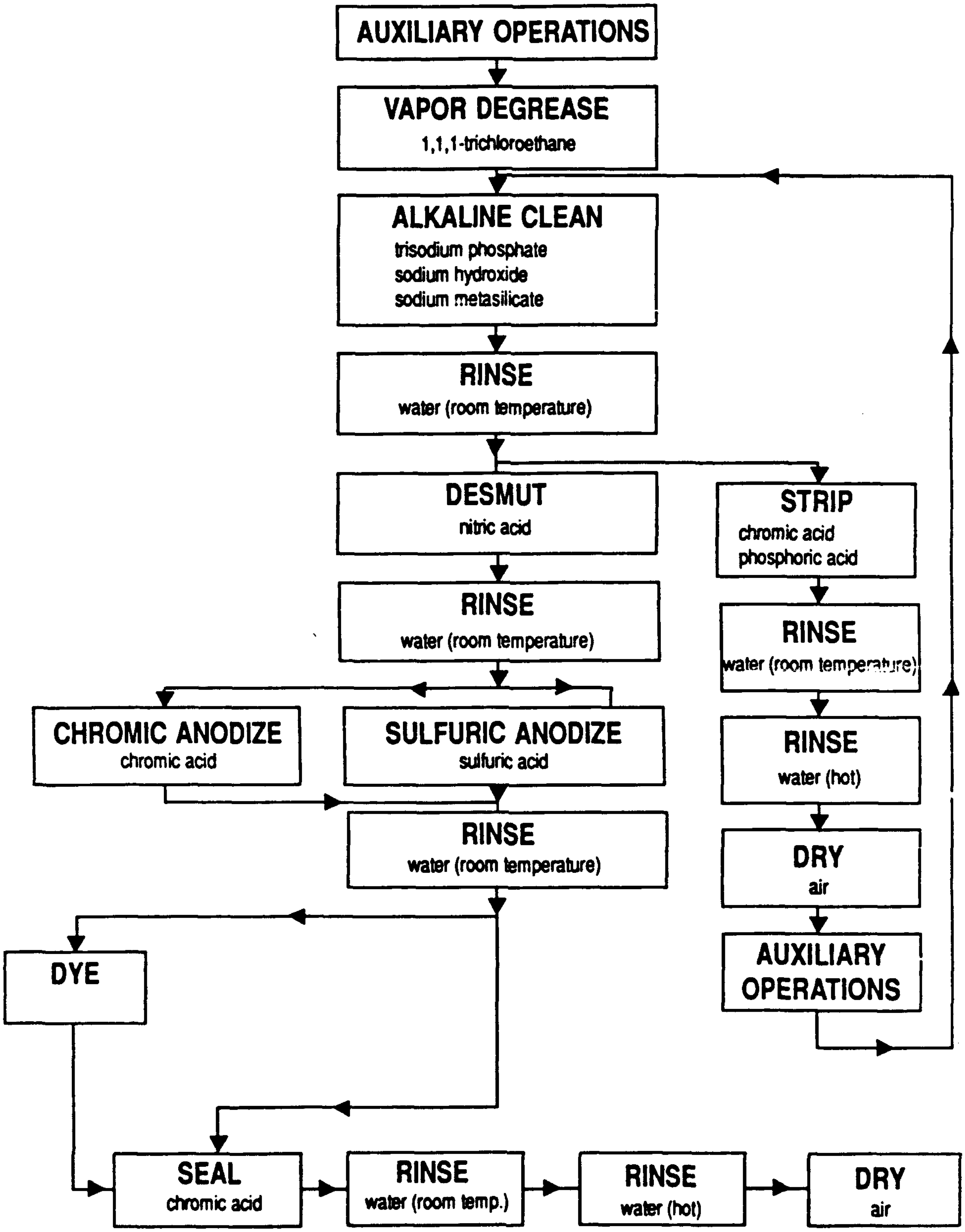
RINSE
water (hot)

↓

DRY
air

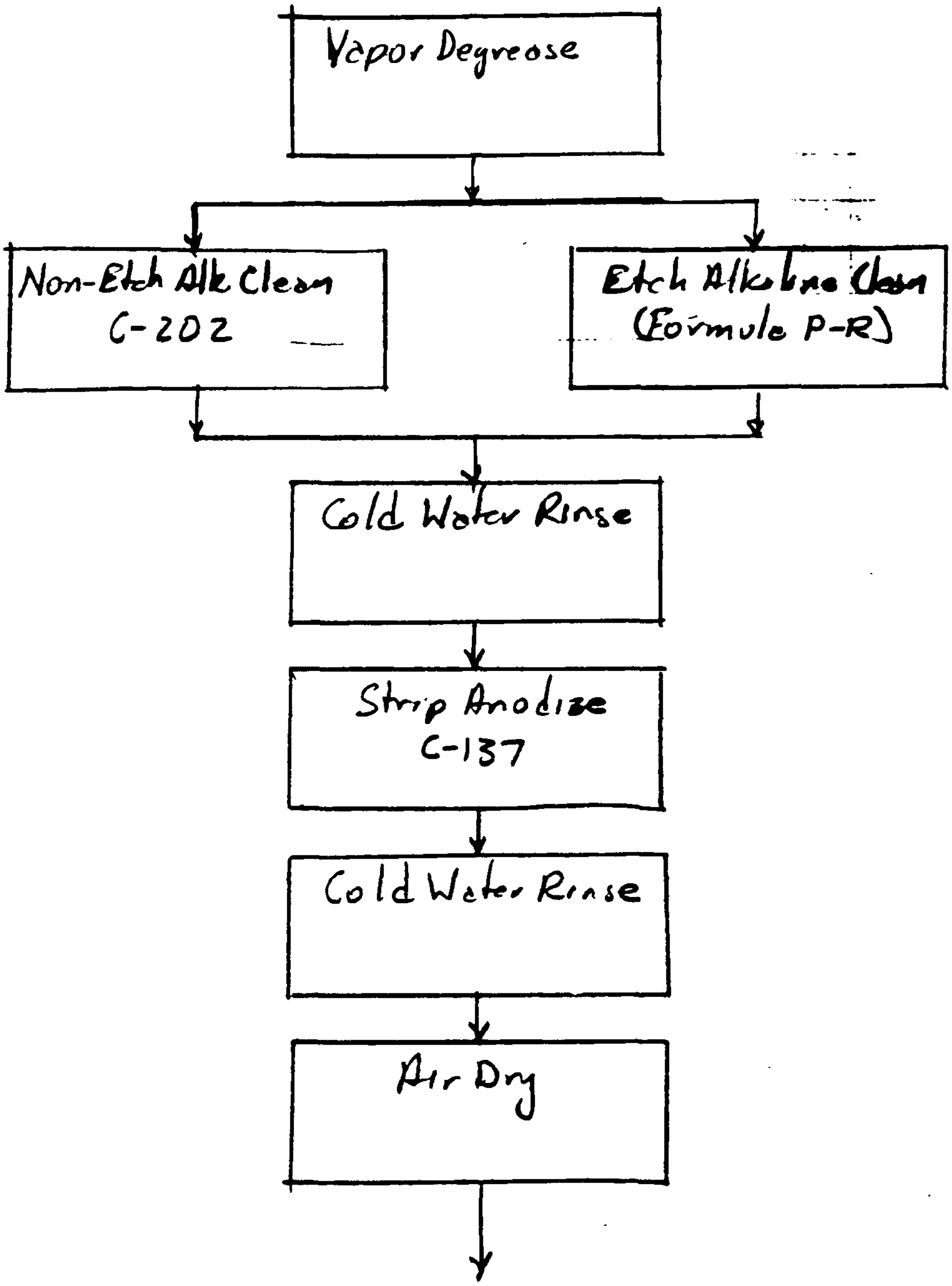
ALUMINUM CONVERSION PROCESS

LSC-20049



ANODIZE PROCESS

LSC-20054A



Aluminum Anodize Strip/00-ALC

Stress-Relief
4 hrs. @ 375 ± 25°F

↓

Shot-Peen
(As-Req'd)

↓

Vapor Degrease

↓

Mask
(When Specified)

↓

Grit-Blast
(When Specified)

↓

Cold Water Rinse

↓

Cyanide Dip
C-423

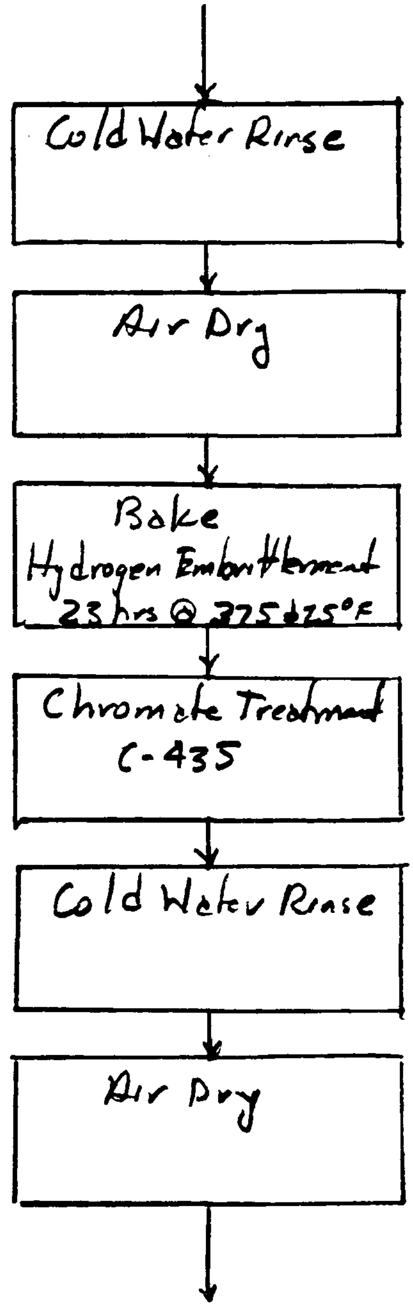
↓

Cadmium Plate
C-405

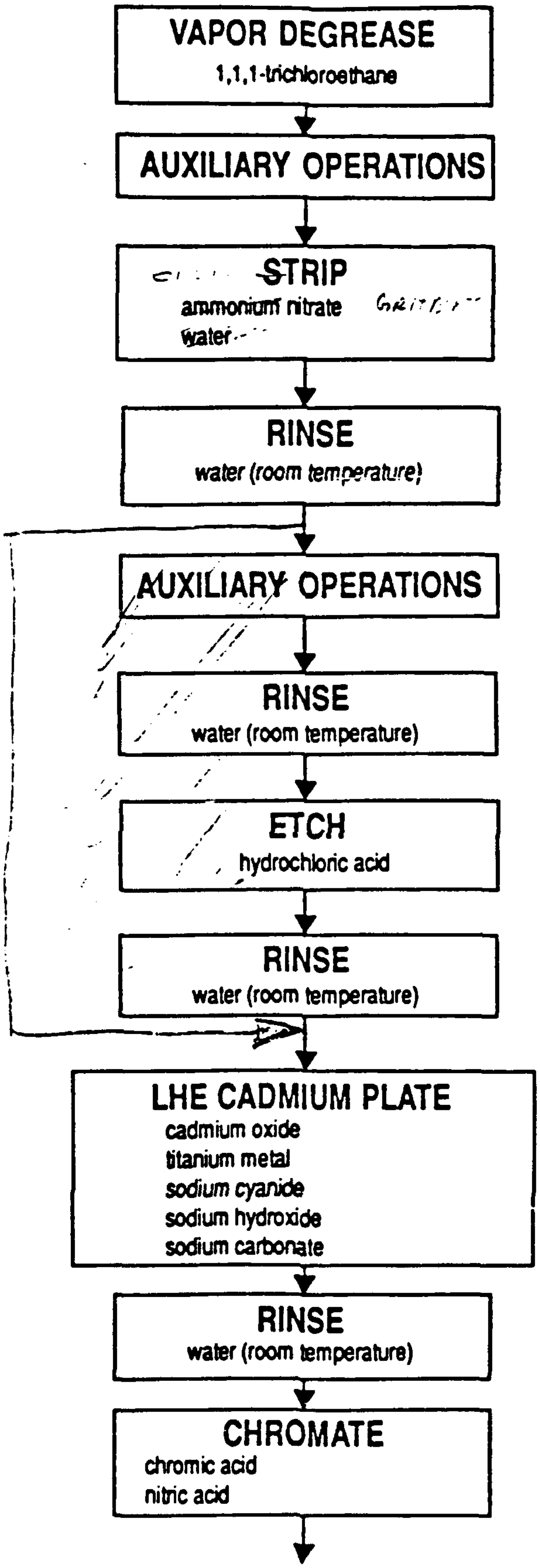
↓

Continued on Next Page

Cadmium Plating of High-Strength Landing-Gear Parts / OO-ALC



Cadmium Plating of High-Strength Landing Gear Parts 100-ALC



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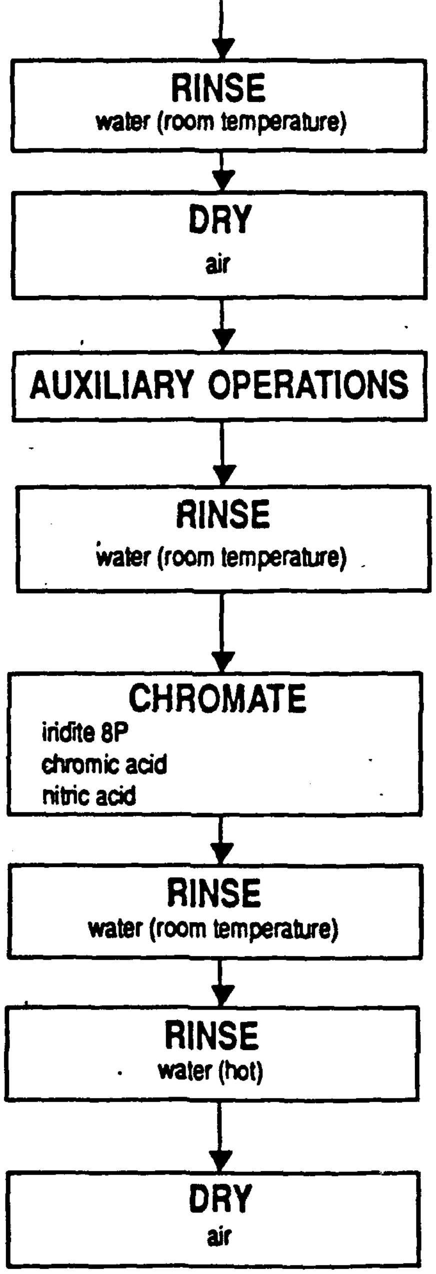
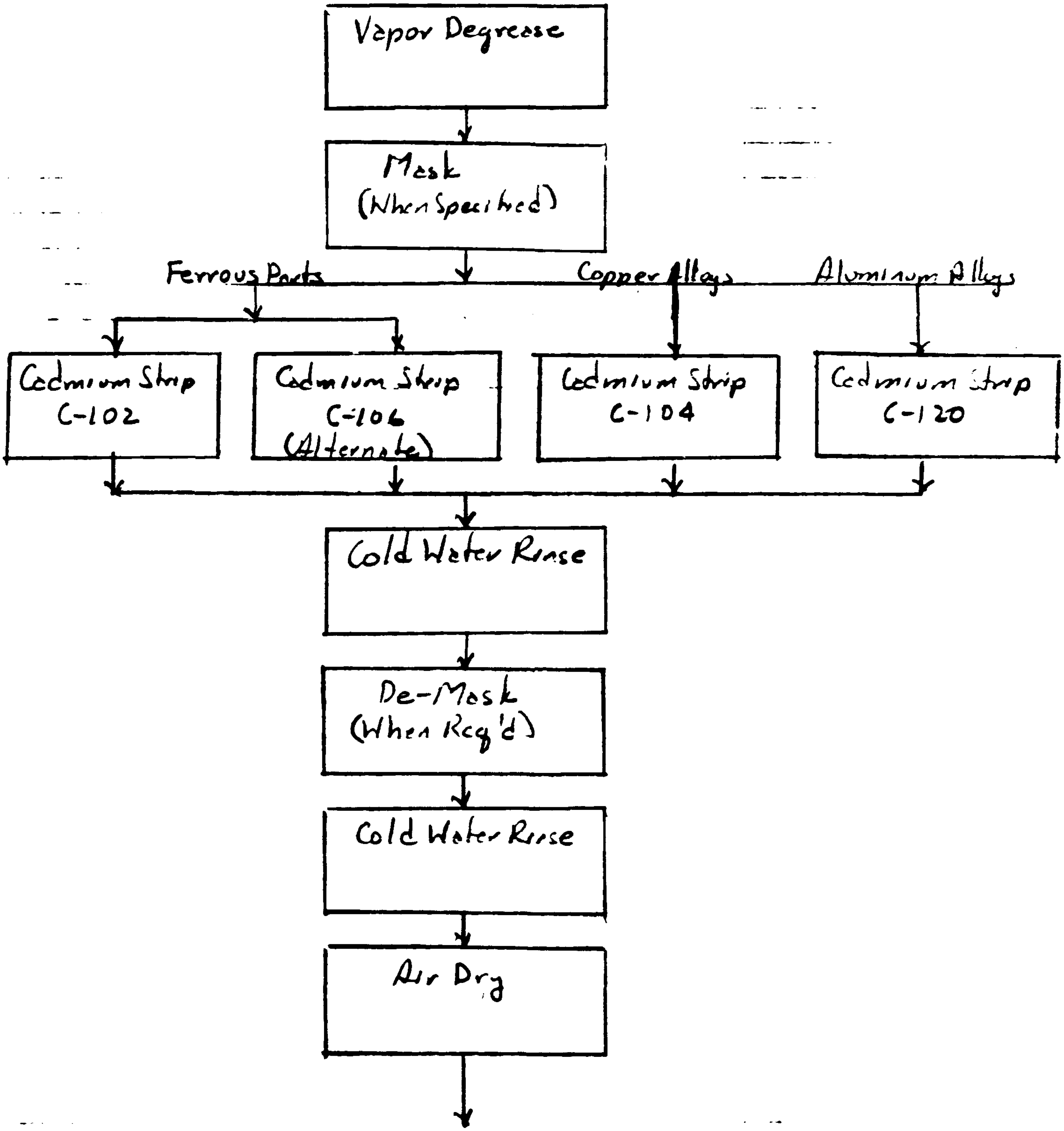
LHE CADMIUM PLATING PROCESS

(CONTINUED FROM PREVIOUS PAGE)

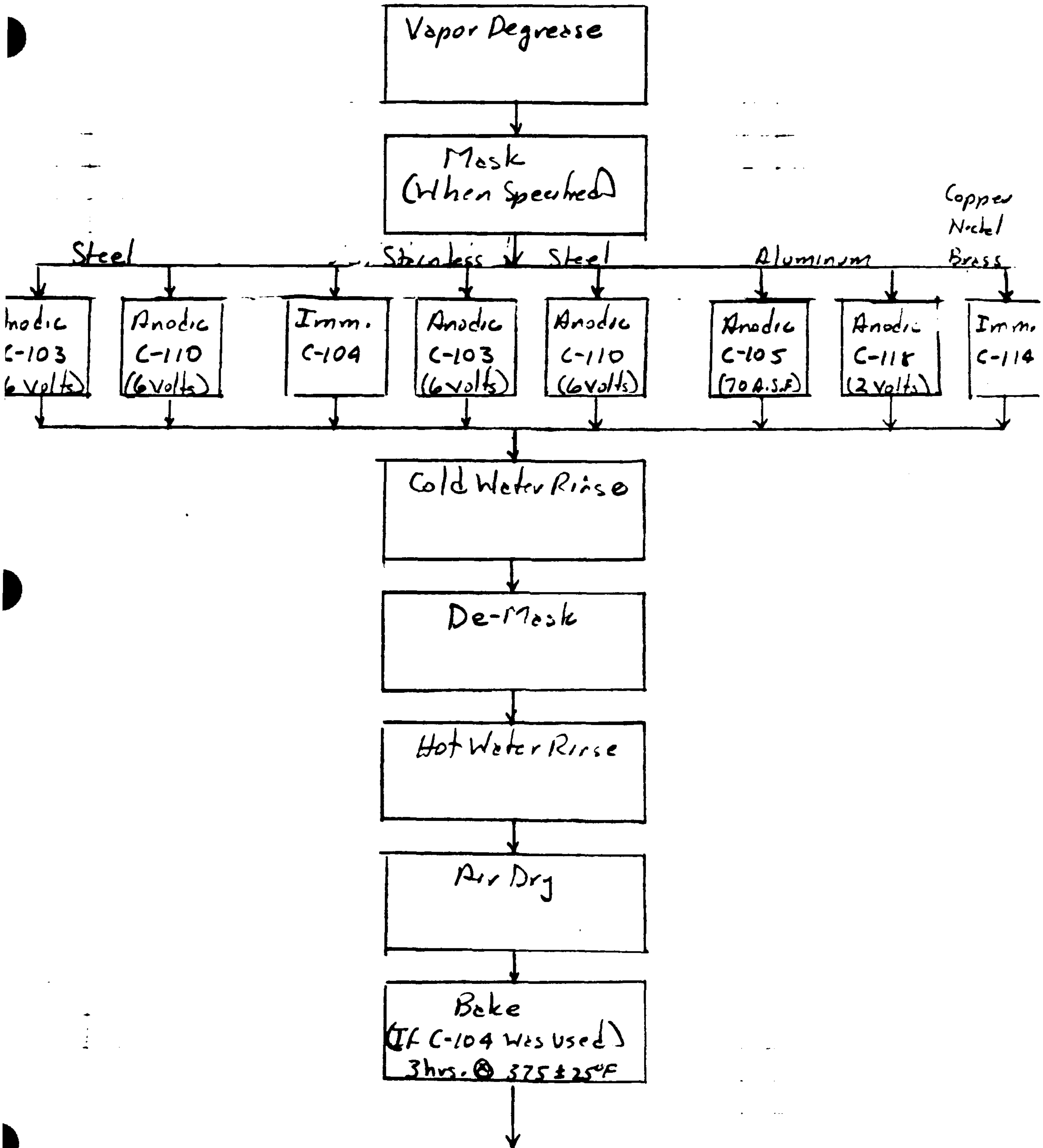


LHE CADMIUM PLATING PROCESS

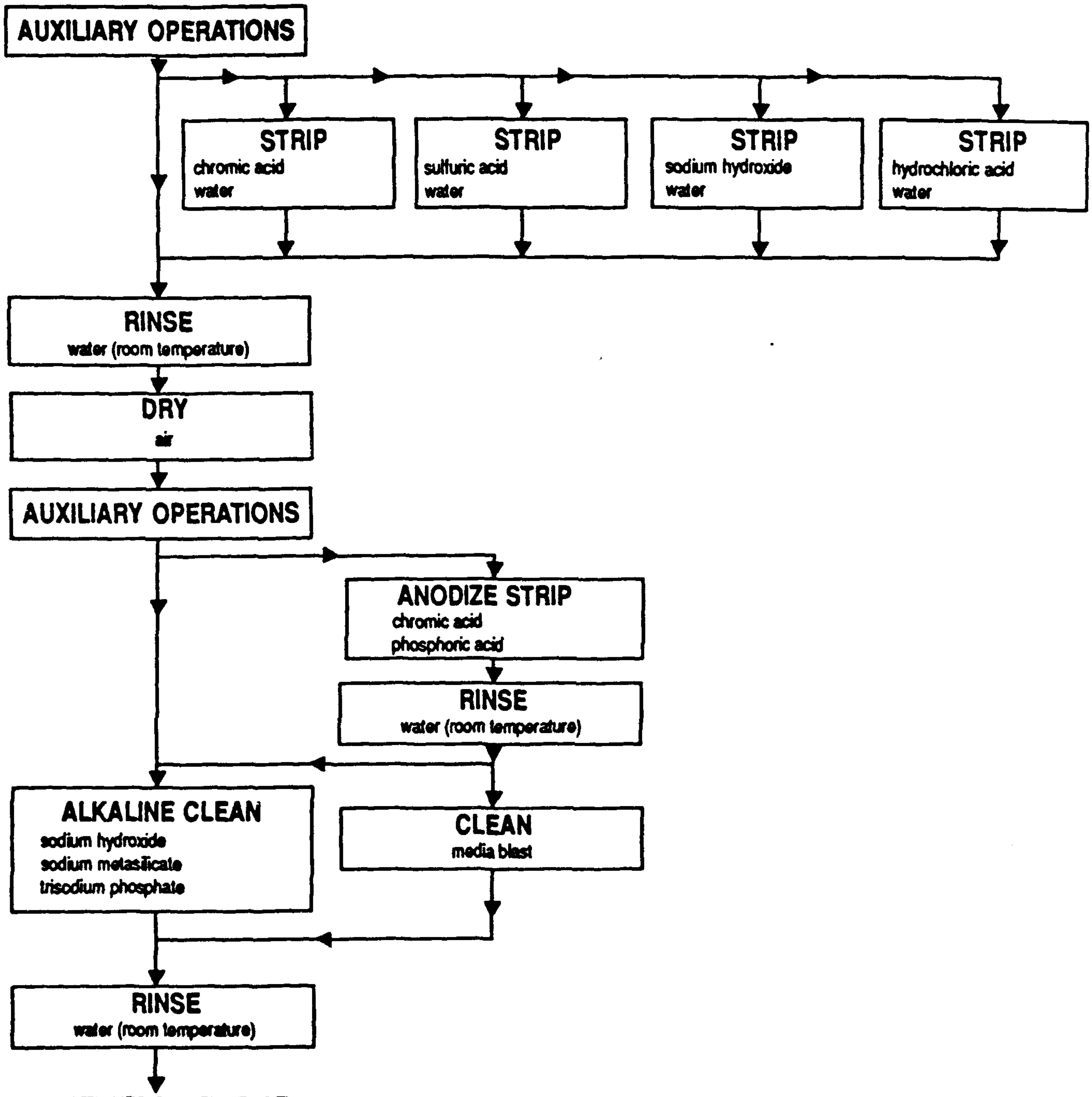
LSC-20058A



Cadmium Plate Stripping / T.O. 42C2-1-7



Chromium Stripping / T.O. 42C2-1-7



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CHROMIUM PLATING PROCESS

LSC-20064A

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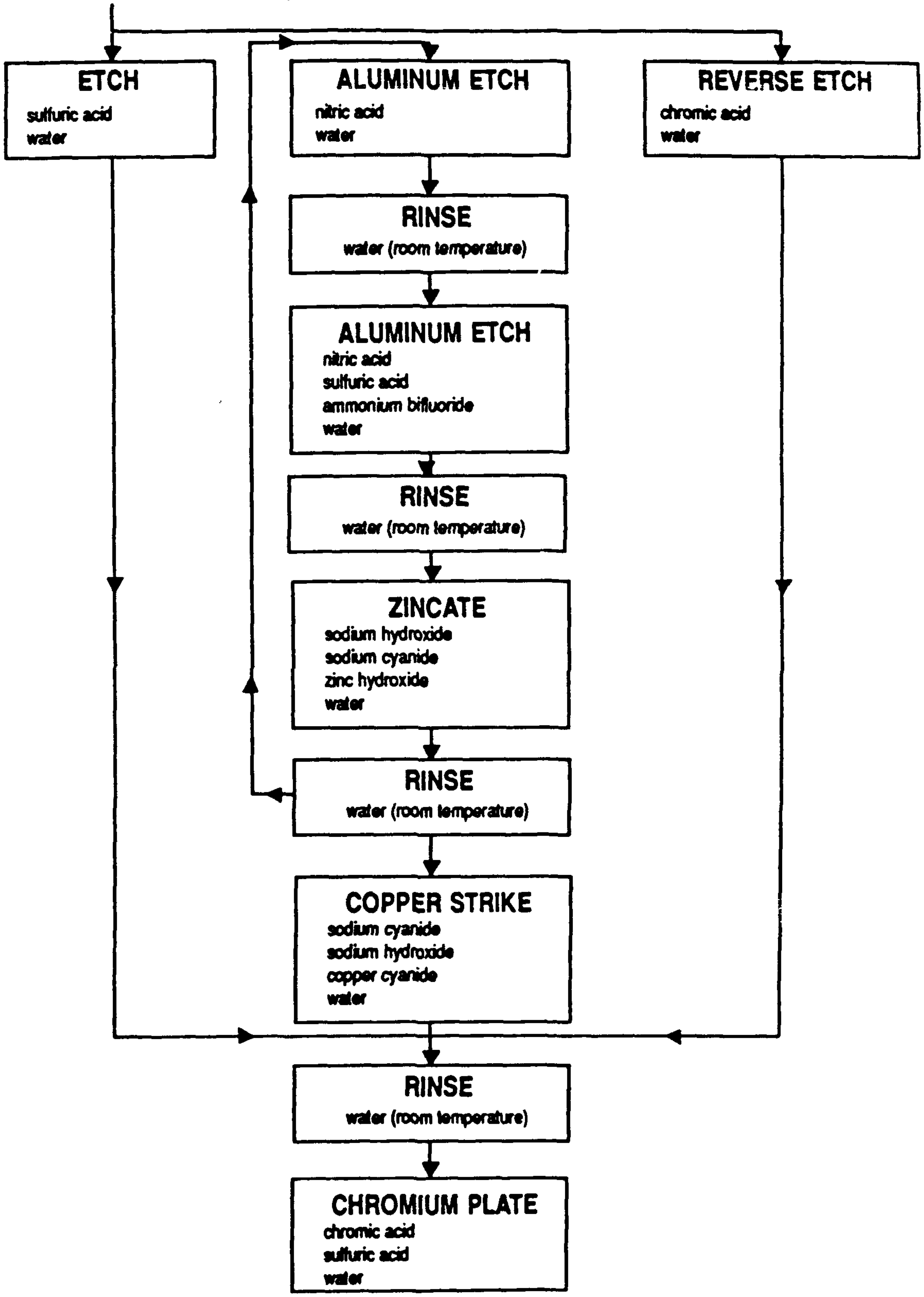
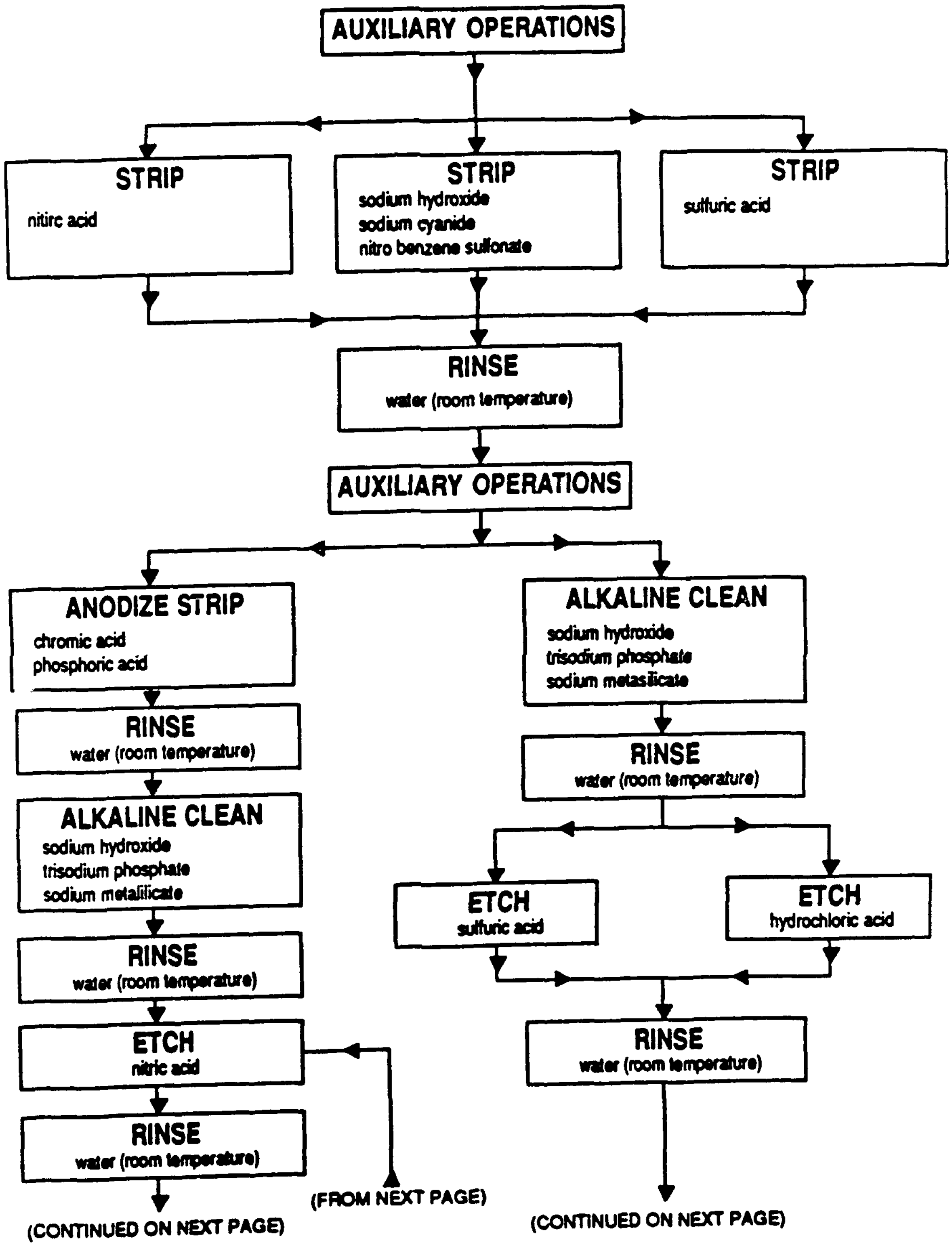


CHROMIUM PLATING PROCESS

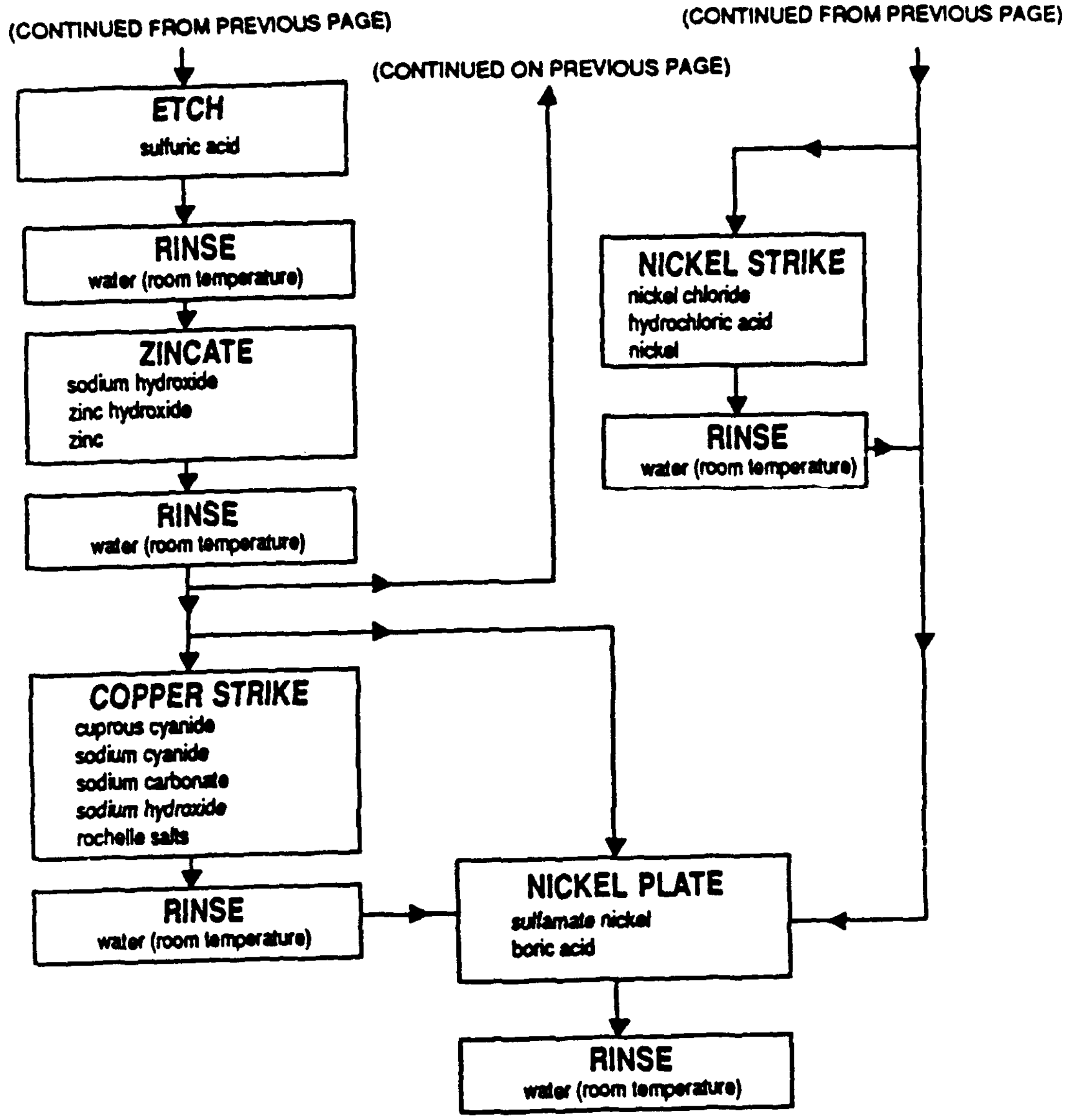
LSC-20064A



NICKEL PLATING PROCESS

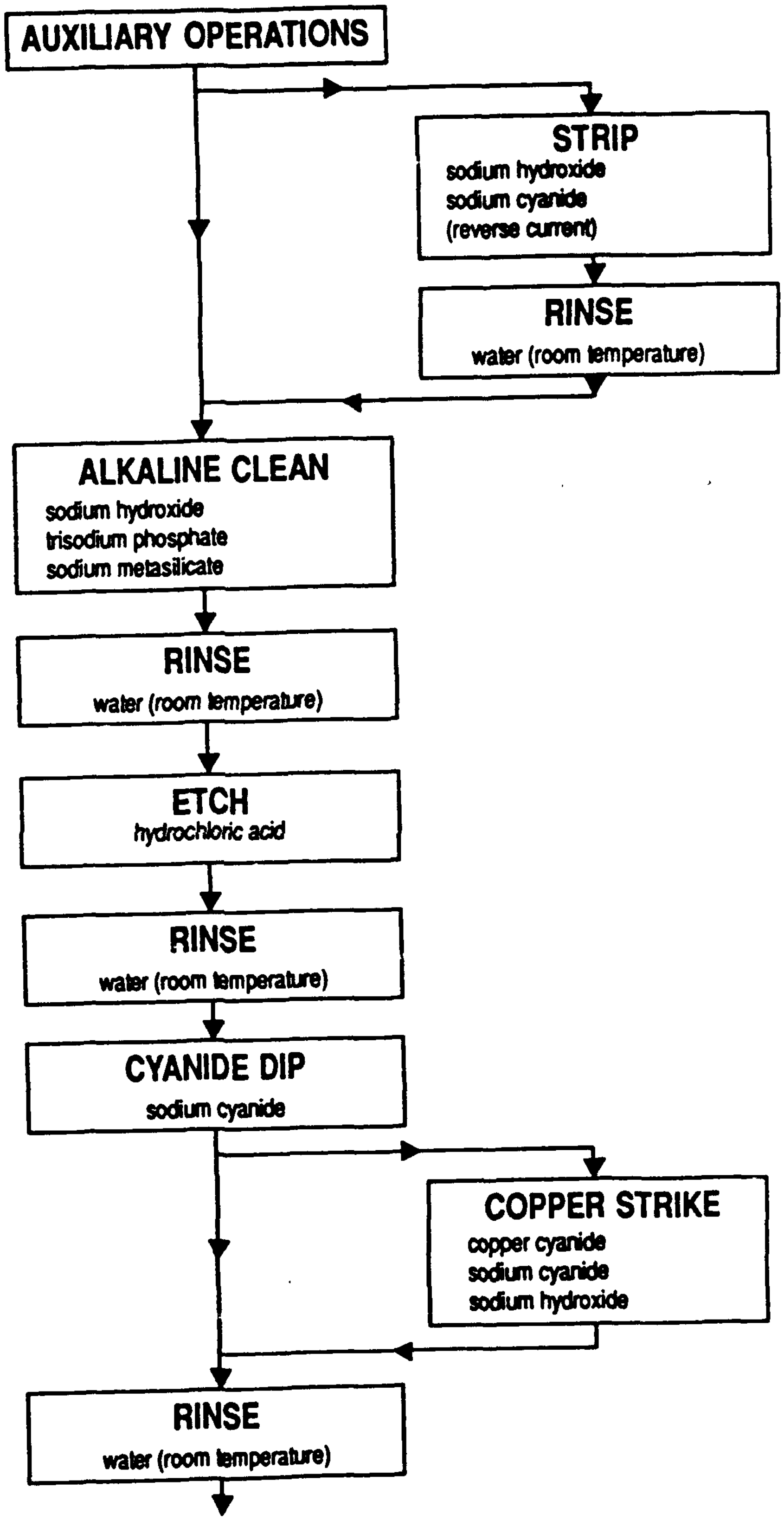
LSC-20066

Pg. 2 of 2



NICKEL PLATING PROCESS

LSC-20066



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SILVER PLATING PROCESS

LSC-20065A

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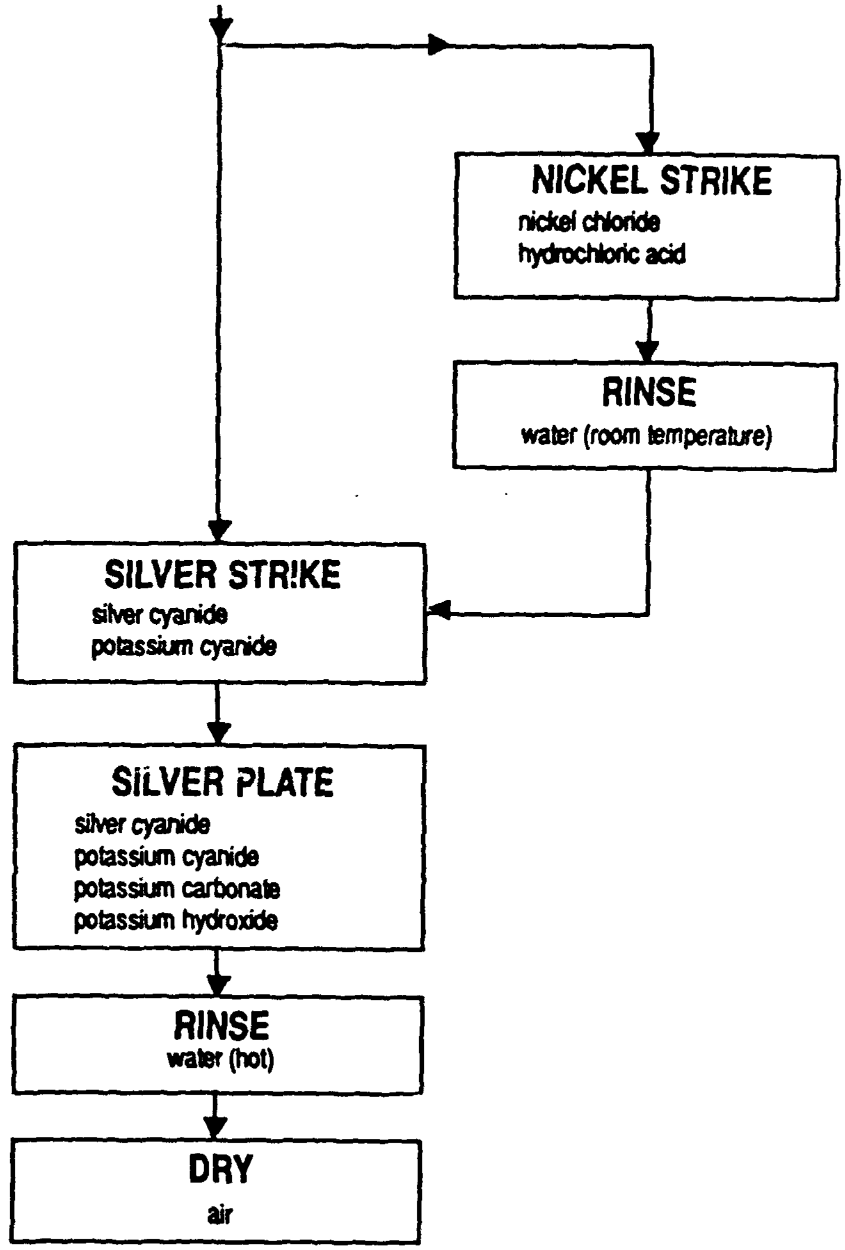

SILVER PLATING PROCESS

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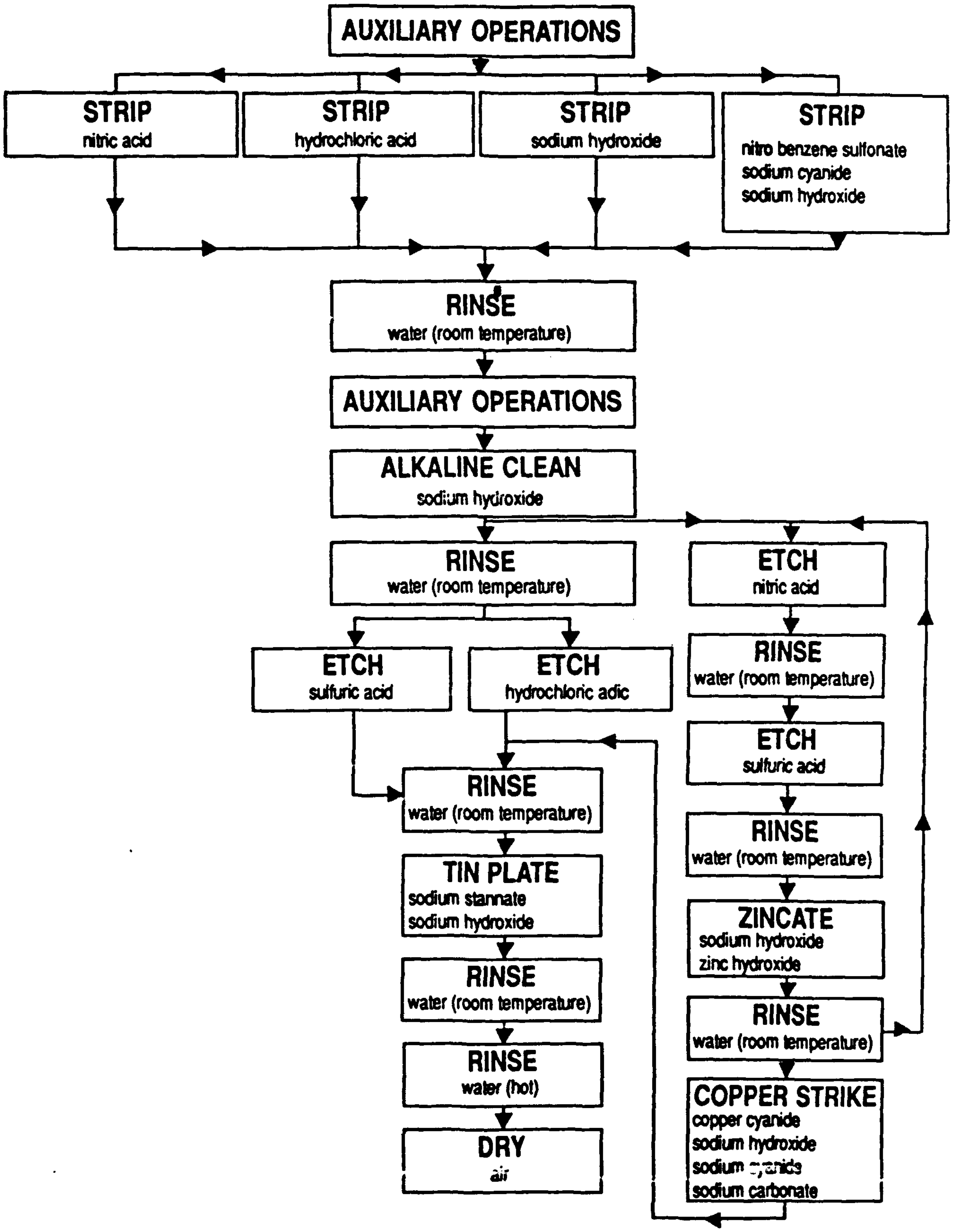
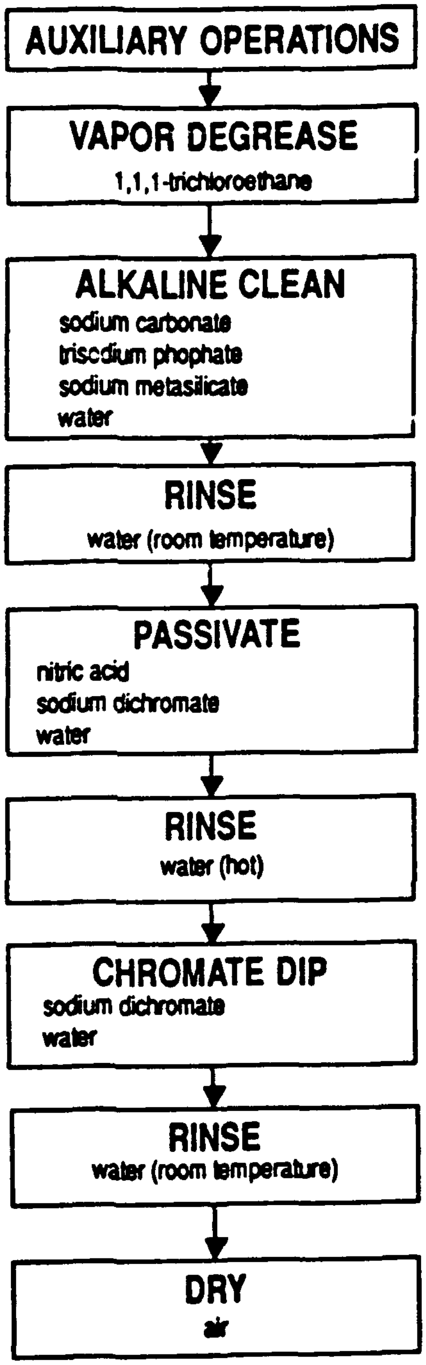


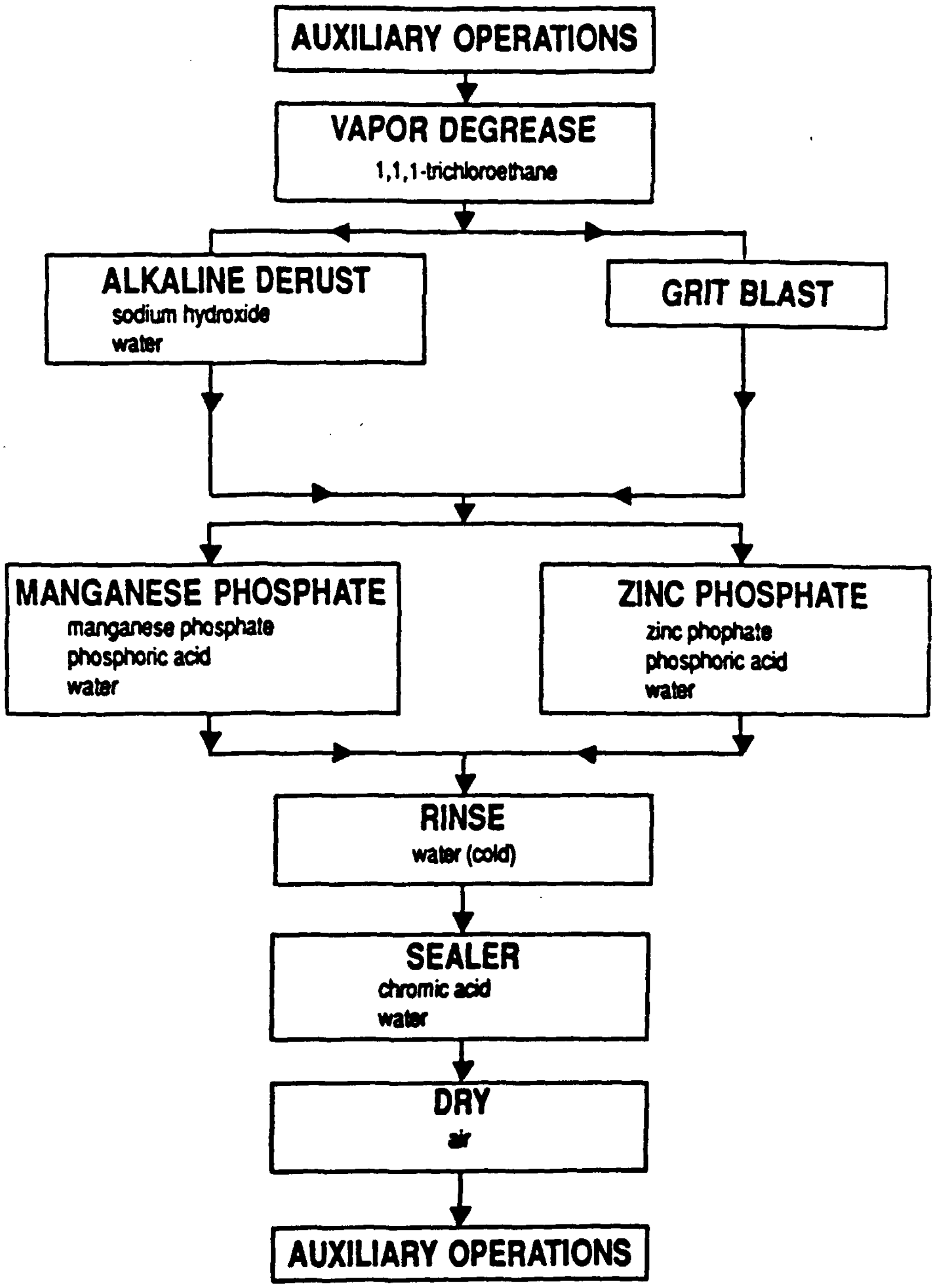
TIN PLATING PROCESS

LSC-20063A



PASSIVATION PROCESS

LSC-20060



PHOSPHATE COATING PROCESS

LSC-20056

OPERATION PROFILE

OPERATION DESCRIPTION

CODE	DESC
ALDO	ALODINE
ANZ1	CHROMIC ANODIZE
ANZ2	SULFURIC ANODIZE
ANZ3	HARD ANODIZE
BAKE	BAKE 4 HR, 24 HR, VARIABLE
BLST	GLASS, GRIT BLAST
BRSH	ANY BRUSH PLATING
BEAD	GLASS BEAD
CAD	CADMIUM PLATE
CHR	CHROMIUM PLATE
CLN	DEGREASE, ALKALINE, FORMULA P, P-K
COAT	DRYFILM LUBRICANT, PAINT
COP	COPPER PLATE
DMSK	DEMASK
DEOX	DEOXIDIZE
DIP	DIP, ACTIVATOR, CHEM RINSE
DRY	SHOP AIR
DYE	RED, BLACK
ETCH	ANY EXCEPT FORM P
HAND	HAND OPERATION
IRID	IRIDITE
IVD	ION VAPOR DEPOSITION
MASK	MASK, ~~[illegible]~~
MOVE	MOVE
NIB	NICKEL BRIGHT
NIEL	ELECTROLESS NICKEL
NIS	NICKEL SULFAMATE
PASS	PASSIVATE
PEEN	GLASS, SHOT PEEN
PHOS	PHOSPHATE MANGANESE
PRES	PRESERVATIVE

CODE	DESC
RINS	RINSE: HOT, WARM, COLD
SEAL	SEAL
SANZ	STRIP ANODIZE
SCAD	STRIP CADMIUM
SCHR	STRIP CHROMIUM
SNI	STRIP NICKEL
SRUS	STRIP RUST
SSI	STRIP SILVER
STIN	STRIP TIN
SKCO	STRIKE COPPER
SKNI	STRIKE NICKEL
SKSI	STRIKE SILVER
SILV	SILVER PLATE
TIN	TIN PLATE
ZINC	ZINCATE
ZZZZ	CHILD WCD ENDPOINT

GENERAL PROCESS FLOW

ALODINE

CLN	DEOX
CLN	RINS
RINS	ALOD
CLN	RINS
RINS	RINS (WARM)
	DRY

ANODIZE

CLN	DEOX
CLN	RINS
RINS	ANZ 2 or 3*
CLN	RINS *
RINS	SEAL (* NICKEL ACET[illegible])
	RINS
	RINS (HOT) *
	DRY

CADMIUM

- MASK
- RINS
- CAD
- RINS
- RINS (HOT)
- DMSK

CHROMIUM

- MASK
- ETCH
- CHR
- RINS
- CLN
- SRUS
- DMSK

IRIDATE
(CHROMATE CONVERSION COATING)

- DIP
- RINS
- IRID
- RINS (WARM)
- DRY

IVD

- CLN
- MASK
- IVD
- DMSK

NICKEL

- CLN
- RINS
- ETCH
- RINS
- NIS
- RINS
- DMSK

STRIP ANODIZE

CLN	CLN
? MASK ?	RINS
	SANZ
	RINS
	RINS (HOT)
? DMSK ?	DRY

STRIP CADMIUM

? CLN ?	SCAD
? MASK ?	RINS
? DMSK ?	DRY

STRIP CHROMIUM

? CLN ?	SCHR
? MASK ?	RINS
	RINS (HOT)
? DMSK ?	DRY

STRIP NICKEL

- CLN
- MASK
- SNI
- RINS
- DMSK

STRIP RUST

- SRUS
- RINS
- DRY

STRIP SILVER

? CLN ?	SSI
? MASK ?	RINS
	DRY

PHOSPHATE	CLN	RINS (HOT)	
	MASK	PHOS	
	BLST	RINS	
		DIP	
		DRY	
		BAKE	
		SEAL	
		DRY	
SILVER	? CLN ?	CLN	
	? MASK?	RINS	
		ETCH	
		RINS	
		SKCO	
		RINS	
		SKNI	
		RINS	
		SKSI	
		SILV	
		RINS (WARM)	
		RINS (HOT)	

GRIT BLAST (ALUMINUM OXIDE GARNET)	CLN
	MASK
	BLST
	DMSK
SHOT PEEN (ALUMINUM STEEL)	PEEN
	CLN
GLASS BEAD	BEAD
	CLN
DRY FILM LUBRICANT	COAT
	BAKE
DEGREASE	CLN

LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 11/22/88 A-E046B-MM1-DY-M45 PAGE 0001

26337A F15 MLG R/M MM RCC MNPRC 4A4-22-3 86224

PER SUB / STEP	TECH / S T D / S K L / W #R K / F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
C001	S N UP EA B	K	88183	.74	PERCENT ENGR 66.4	F-15 MAIN OUTER CYLINDER	3.05		2.25			
0001	UP 01	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0030					68A410702-1005	1620010760547						
0040					68A410702-1006	1620040753562						
0022	UP 01	24		1.00		DEGREASE	.097	.023	.120		4	
0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0023	UP 01	24		.95		STRIP CAD	.262	.060	.309	.5	10	
0010	E		ZCD-ST-M1	1.00	STRIP CAD ID/OD MED/LRG PART		.25260		.313			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0024	UP 01	24		.05		STRIP RUST	.262	.003	.016	.3	1	
0010	E		ZCD-ST-M1	1.00		STRIP RUST	.25260		.313			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0098	UP 01	24		1.00		DEGREASE	.097	.023	.120		4	
0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100	UP 01	24		.05		STRIP CHROME MED PART O.D.	.186	.002	.012	24.0	0	
0010	E		ZCR-ST-M2	.50	STRIP CHROME OD MED/LRG PARTOCC. 2 EA OPERATIONS		.35303		.218			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110	UP 01	24		.05		STRIP CHROME MED PART O.D.	.186	.002	.012	24.0	0	
0010	E		ZCR-ST-M2	.50	STRIP CHROME OD MED/LRG PARTOCC. 2 EA OPERATIONS		.35303		.218			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0113	UP 01	24		.05		STRIP CHROME MED PART I.D.	.494	.006	.031	24.0	1	
0010	E		ZCR-ST-M1	1.00	STRIP CHROME ID MED/LRG PART		.48467		.600			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0150	UP 01	24		.50		BAKE AFTER ETCH	.171	.021	.106	8.0	3	
0010	E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0165	UP 01	24		.50		DEGREASE	.097	.012	.060		2	
0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170	UP 01	24		.50		SHOTPEEN MED PART/MASK	.391	.047	.243		8	
0010	E		ZMA-CL-02	1.00	MASK MED CYLINDRICAL PART		.17000		.210			
0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	M		ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0175	UP 01	24		.05		PREP FOR CHROME MED PART O.D	.720	.009	.045		1	
0010	M			1.00		PREP FOR CHRMOE	.71000		.880			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0178	UP 01	24		.05		GRIT BLAST	.111	.001	.007		0	
0010	E		RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0180	UP 01	24		.05		CHROME PLATE MED PART O.D.	.600	.007	.037	24.0	1	
0010	M			1.00		CHROME PLT MED PART O.D.	.59000		.731			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0185	UP 01	24		.05		BAKE AFTER CHROME PLATE	.171	.002	.011	8.0	0	
0010	E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0191	UP 01	24		.05		BAKE AFTER GRIND	.171	.002	.011	8.0	0	

OUTER CYLINDER

0010 E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
[illegible]	UP 01	24		.40		GRIT BLAST	.111	.011	.055		2
0010 E			RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0194	UP 01	24		.40		PREP FOR CHROME MED PART I.D	.940	.090	.466		15
0010 N				1.00		PREP CHROME I.D.	.93000		1.153		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0195	UP 01	24		.40		CHROME PLATE MED PART I.D.	.640	.061	.317	30.0	10
0010 N				1.00		CHROME PLATE MED PART	.63000		.781		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0200	UP 01	24		.40		BAKE AFTER CHROME PLATE	.171	.016	.085	8.0	3
0010 E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0202	UP 01	24		.05		PREP FOR CHROME MED PART O.D	.720	.009	.045		1
0010 N				1.00		PREP FOR CHRMOE	.71000		.880		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0204	UP 01	24		.05		GRIT BLAST	.111	.001	.007		0
0010 E			RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0206	UP 01	24		.05		CHROME PLATE MED PART I.D.	.640	.008	.040	30.0	1
0010 N				1.00		CHROME PLATE MED PART	.63000		.781		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0207	UP 01	24		.05		BAKE AFTER CHROME PLATE	.171	.002	.011	8.0	0
0010 E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0225	UP 01	24		.40		BAKE AFTER GRIND	.171	.016	.085	8.0	3
0010 E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0235	UP 01	24		.40		DEGREASE	.097	.009	.048		2
0010 E			RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0300	UP 01	24		1.00		GRIT BLAST	.111	.027	.139		5
0010 E			RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0370	UP 01	24		.45		CAD PLATE	.620	.067	.346		11
0010 E			ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART		.61058		.757		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0380	UP 01	24		.45		BAKE AFTER CAD PLATE	.171	.019	.096	38.0	3
0010 E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0385	UP 01	24		.45		CHROMATE CONVERSION(IRIDITE)	.106	.011	.059		2
0010 E			ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST		.09635		.119		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0390	UP 01	24		.50		VAC CAD MED PART	.080	.010	.050	1.0	2
0010 E			ZPL-VC-S1	1.20	VAC CAD PLATE SMALL PART	OCC FOR MED SIZED PART	.05856		.087		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0395	UP 01	24		.50		HOT WATER RINSE	.030	.004	.019		1
0010 N				1.00		HOT WATER RINSE	.02000		.024		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0397	UP 01	24		.05		I.V.D. ALUMINUM PLATE	.450	.005	.028	1.0	1
0010 N				1.00		I.V.D. PLATE	.44000		.545		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
3	UP 01	24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0
0010 N				1.00		ALODINE	.22000		.272		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		

```
9000       UP 01   24          .01                        LABOR STANDARD HISTORY          .000   .000    .000      0
     0010                         14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <  3.38
     0011                         18MAR85 DOWN GRADED NOT MARKET BASKET
     0012                         21NOV85 CHANGED SUBOPS TO MATCH 958  OLS STD  3.07
     0900                          J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
<--X----X--->
1234567890123456  ELSE PUT IN END
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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 11/22/88 A-E046B-MM1-DY-M45 PAGE 0001

26337A F15 MLG R/H MM RCC MNPRC 4A4-22-3 86224

PE[illegible] SUB STEP	TECH T D	S K L	S W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
C002	E	N	UP	EA	B	K 88203	.96	PERCENT ENGR 45.3	PLATE PISTON ASSY. F-15MLG	12.61		12.11			
0001			UP	01	00		.00		PART NUMBER/STOCK NUMBER	.000	.000	.000			0
0030								68A4107004-1011	1620010803404						
0040								68A410704-1012	1620010803401						
0050								68A410704-1005	1620010803401						
0060								68A410704-1006	1620010818799						
0024			UP	01	24		1.00		DEGREASE	.097	.023	.120			1
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026			UP	01	24		.95		STRIP CAD	.262	.060	.309	.5		2
0010	E					ZCD-ST-M1	1.00	STRIP CAD ID/OD MED/LRG PART		.25260		.313			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028			UP	01	24		.05		STRIP RUST	.262	.003	.016	.3		0
0010	E					ZCD-ST-M1	1.00		STRIP RUST	.25260		.313			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0049			UP	01	24		1.00		DEGREASE	.097	.023	.120			1
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01	24		1.00		STRIP CHROME MED PART O.D.	.363	.087	.450	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
[illegible]0			UP	01	24		1.00		STRIP CHROME MED PART I.D.	.494	.119	.613	24.0		5
0010	E					ZCR-ST-M1	1.00	STRIP CHROME ID MED/LRG PART		.48467		.600			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0062			UP	01	24		1.00		STRIP CHROME MED PART O.D.	.363	.087	.450	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0065			UP	01	24		1.00		STRIP CHROME MED PART O.D.	.363	.087	.450	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01	24		1.00		BAKE AFTER ETCH	.171	.041	.213	8.0		2
0010	E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0115			UP	01	24		1.00		DEGREASE	.097	.023	.120			1
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120			UP	01	24		1.00		SHOTPEEN MED PART/MASK	.391	.094	.486			4
0010	E					ZMA-CL-02	1.00	MASK MED CYLINDRICAL PART		.17000		.210			
0020	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0123			UP	01	24		1.00		GRIT BLAST	.111	.027	.139			1
0010	E					RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0127			UP	01	24		1.00		PREP FOR CHROME MED PART I.D	.940	.226	1.166			9
0010	N						1.00		PREP CHROME I.D.	.93000		1.153			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01	24		1.00		CHROME PLATE MED PART I.D.	.640	.154	.794	30.0		6
0010	N						1.00		CHROME PLATE MED PART	.63000		.781			

0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0135	UP	01	24		1.00		BAKE AFTER CHROME PLATE	.171	.041	.213	8.0	2
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0138	UP	01	24		1.00		PREP FOR CHROME MED PART O.D	.720	.173	.893		7
0010	N				1.00		PREP FOR CHRMOE	.71000		.880		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0139	UP	01	24		1.00		GRIT BLAST	.111	.027	.139		1
0010	E			RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0140	UP	01	24		1.00		CHROME PLATE MED PART O.D.	.600	.144	.744	24.0	6
0010	N				1.00		CHROME PLT MED PART O.D.	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0150	UP	01	24		1.00		PREP FOR CHROME MED PART O.D	.720	.173	.893		7
0010	N				1.00		PREP FOR CHRMOE	.71000		.880		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0152	UP	01	24		1.00		PREP FOR CHROME MED PART O.D	.720	.173	.893		7
0010	N				1.00		PREP FOR CHRMOE	.71000		.880		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0154	UP	01	24		1.00		GRIT BLAST	.111	.027	.139		1
0010	E			RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0156	UP	01	24		1.00		CHROME PLATE MED PART O.D.	.600	.144	.744	24.0	6
0010	N				1.00		CHROME PLT MED PART O.D.	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0157	UP	01	24		1.00		CHROME PLATE MED PART O.D.	.600	.144	.744	24.0	6
0010	N				1.00		CHROME PLT MED PART O.D.	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
8	UP	01	24		1.00		BAKE AFTER CHROME PLATE	.171	.041	.213	8.0	2
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0180	UP	01	24		.25		BAKE AFTER GRIND	.171	.010	.053	8.0	0
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0195	UP	01	24		1.00		DEGREASE	.097	.023	.120		1
0010	E			RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0205	UP	01	24		1.00		GRIT BLAST	.111	.027	.139		1
0010	E			RPL-SB-M2	1.00	SANDBLAST MED PART WALK-IN B		.10180		.126		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0210	UP	01	24		.95		CAD PLATE	.620	.141	.731		6
0010	E			ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART		.61058		.757		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0220	UP	01	24		.95		BAKE AFTER CAD PLATE	.171	.039	.202	38.0	2
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0225	UP	01	24		1.00		VAC CAD MED PART	.080	.019	.100	1.0	1
0010	E			ZPL-VC-S1	1.20	VAC CAD PLATE SMALL PART	OCC FOR MED SIZED PART	.05856		.087		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0227	UP	01	24		1.00		HOT WATER RINSE	.030	.007	.037		0
0010	N				1.00		HOT WATER RINSE	.02000		.024		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0230	UP	01	24		1.00		CHROMATE CONVERSION(IRIDITE)	.106	.026	.132		1
0010	E			ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST		.09635		.119		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0233	UP	01	24		.05		I.V.D. ALUMINUM PLATE	.450	.005	.028	1.0	0

0010 N				1.00	I.V.D. PLATE	.44000		.545	
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
34	UP 01	24		.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014	0
0010 N				1.00	ALODINE	.22000		.272	
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012	
9000	UP 01	24		.01	LABOR STANDARD HISTORY	.000	.000	.000	0
0010					14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .60				
0011					18MAR85 DOWN GRADED NOT MARKET BASKET				
0012					21NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD 3.05				
0900					J CALDWELL TECH MANEAA				

TO INTERROGATE LABOR STANDARDS, INPUT

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 RCC PRD NROP NR
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                            LABOR STANDARD OP   ION RESOURCE STANDARD AND METHOD ANALYSIS   /02/88   A-E046D-MM1-DY-M45  PAGE  0001
        26337A      F15 MLG R/H MW                               RCC MMPRC                    -4-22-3              86224
OPER    TECH S S    W F PF A/R REV
  SUB        T K   #R A FA SUPPORT   OCC <------------------- DESCRIPTION -------------------> BASE    PFD    STD             A
        STEP D L    K C DC ELEMENT   FACT            STORED                  SUPPLEMENTAL        HOURS   TIME   HOURS    DLY PCT C
----------------------------------------------------------------------------------------------------------------------------------
 03      S  E UP EA B     J 88187   .61 PERCENT ENGR 99.9          ORIFICE TUBE, F-15 M          1.73          1.05
  0001        UP 01    00           .00                             PART NUMBER/NSN               .000   .000   .000          0
        0010                             68A410726-1001       1620003486485
  0030        UP 01    24           1.00                            STRIP ANODIZE MED PART        .136   .033   .169    .5  10
        0010 E          ZCD-ST-S1  1.00                             STRIP ANODIZE                 .12630        .156
        0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  0050        UP 01    24           1.00                            ANODIZE MED PART              .460   .111   .571    .8  33
        0010 E          RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                               .08709        .107
        0020 E          ZPL-AN-M1  1.00 ANODIZE MEDIUM SIZE PART                                 .36341        .450
        0030 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  0060        UP 01    24           1.00                            HARD ANODIZE MED PART .001    .803   .193   .996    .8  57
        0010 E          RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                               .08709        .107
        0020 E          RPL-AN-H1  1.00 HARD ANO TO .001 SM-MED PART                             .70637        .875
        0030 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  9000        UP 01    24            .01                            LABOR STANDARD HISTORY        .000   .000   .000          0
        0010                             14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <   .60
        0011                             18MAR85 DOWN GRADED NOT MARKET BASKET
        0012                             21NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD  3.05
        0900                              J CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 CC PRD NROP NR
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LABOR STANDARD OP[illegible]ION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]/02/88 A-E046D-MM1-BY-M45 PAGE 0001

26337A F15 MLG R/H HW RCC MMPRC [illegible]-22-3 86224

OPER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R SUPPORT ELEMENT	REV OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
[illegible]04	S	E	UP	EA	B	J	88187	.13	PERCENT ENGR 86.9	TORQUE ARM F-15 2 EA	.77		.10			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									68A410646-2005	1620001386306						
0034			UP	01		24		1.00		DEGREASE	.097	.023	.120		16	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0036			UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	21	
0010		E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0038			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01		24		.05		STRIP CHROME SMALL PART O.D.	.054	.001	.003	24.0	0	
0010		E					ZCR-ST-S2	.25	STRIP CHROME O.D. SMALL PARTOCC 4 EA OPERATIONS		.17652		.054			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01		24		.05		STRIP CHROME SMALL PART I.D.	.070	.001	.004	24.0	1	
0010		E					ZCR-ST-S1	.25	STRIP CHROME I.D.SMALL PART OCC 4 EA OPERATIONS		.24234		.075			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060			UP	01		24		.05		STRIP CHROME SMALL PART O.D.	.054	.001	.003	24.0	0	
0010		E					ZCR-ST-S2	.25	STRIP CHROME O.D. SMALL PARTOCC 4 EA OPERATIONS		.17652		.054			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070			UP	01		24		.05		STRIP CHROME SMALL PART I.D.	.070	.001	.004	24.0	1	
0010		E					ZCR-ST-S1	.25	STRIP CHROME I.D.SMALL PART OCC 4 EA OPERATIONS		.24234		.075			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0145			UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0150			UP	01		24		.05		GRIT BLAST	.046	.001	.003		0	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0155			UP	01		24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		3	
0010		N						1.00		PREP FOR CHRMOE	.35500		.440			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0160			UP	01		24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	1	
0010		N						.50		OCC 2 EA OPERATIONS	.29000		.179			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170			UP	01		24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	1	
0010		N						.50		OCC 2 EA OPERATIONS	.29000		.179			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0173			UP	01		24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0175			UP	01		24		.05		GRIT BLAST	.046	.001	.003		0	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0177			UP	01		24		.05		PREP FOR CHROME SM PART I.D.	.245	.003	.015		2	
0010		N						.50		OCC 2 EA OPERATIONS	.47000		.291			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0180			UP	01		24		.05		CHROME PLATE SMALL PART I.D.	.170	.002	.011	30.0	1	
0010		N						.50		OCC 2 EA OPERATIONS	.32000		.198			

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 -0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0190      UP 01   24          .05                     CHROME PLATE SMALL P[illegible]I.D.  .170   .002    .011 30.0   1
  0010 N                      .50                     OCC 2 EA OPERATIONS             .32000         .198
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0200      UP 01   24          .05                     BAKE AFTER CHROME PLATE         .090   .001    .006  8.0   1
  0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                           .08088         .100
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0250      UP 01   24          .05                     BAKE AFTER GRIND                .090   .001    .006  8.0   1
  0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                           .08088         .100
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0265      UP 01   24          .05                     DEGREASE                        .097   .001    .006        1
  0010 E         RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                           .08709         .107
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0275      UP 01   24         1.00                     GRIT BLAST                      .046   .011    .058        7
  0010 E         RWB-CB-B1  1.00 BLAST SM PT OR BSKT V/SM PTS                         .03668         .045
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0280      UP 01   24          .95                     CAD PLATE                       .102   .023    .120       15
  0010 E         ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                             .09212         .114
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0290      UP 01   24          .95                     BAKE AFTER CAD PLATE            .090   .021    .107 38.0  14
  0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                           .08088         .100
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0300      UP 01   24          [illegible]             [illegible]                     .033   .008    .040        5
  0010 E         ZPL-IR-S1  1.00 IRIDITE SMALL PART                                   .02362         .029
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0313      UP 01   24          .05                     I.V.D. ALUMINUM PLATE           .230   .003    .014  1.0   2
  0010 N                     1.00                     I.V.D. PLATE                    .22000         .272
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                        .01001         .012
0317      UP 01   24          .05                     ALODINE I.V.D. ALUM PLATE       .230   .003    .014        2
  0010 N                     1.00                     ALODINE                         .22000         .272
  0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                        .01001         .012
9000      UP 01   24          .01                     LABOR STANDARD HISTORY          .000   .000    .000        0
  0010                             14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <   .07
  0011                             18MAR85 DOWN GRADED NOT MARKET BASKET
  0012                             22NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD   .10
  0900                              J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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LABOR STANDARD OPT[illegible]ION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]/02/88 A-E046B-MM1-DY-M45 PAGE 0001

26337A F15 MLG R/H HW RCC MMPRC [illegible]4-22-3 86224

OPER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
[illegible]06	S	E	UP	EA	B		J 88188	.07	PERCENT ENGR 90.7	APEX PIN-JURY LINK, F15 MAIN	.74		.05			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									68A410764-2001	5315005546340						
0025			UP	01		24		1.00		DEGREASE	.097	.023	.120		16	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0030			UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	22	
0010		E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0035			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01		24		.05		STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	2	
0010		E					ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070			UP	01		24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0085			UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090			UP	01		24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		2	
0010		E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0093			UP	01		24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		3	
0010		N						1.00		PREP FOR CHRMOE	.35500		.440			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0097			UP	01		24		.05		GRIT BLAST	.046	.001	.003		0	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01		24		.05		CHROME PLATE SMALL PART O.D.	.300	.004	.019	24.0	2	
0010		N						1.00		CHROME PLATE SMALL PART O.D.	.29000		.359			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110			UP	01		24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0145			UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0155			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		8	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0160			UP	01		24		.95		CAD PLATE	.102	.023	.120		16	
0010		E					ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170			UP	01		24		.95		BAKE AFTER CAD PLATE	.090	.021	.107	38.0	14	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

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0175        UP 01   24            .95                                CHROMATE CONVERSION(IRIDITE)   [illegible]  [illegible]   [illegible]
   0010 E           ZPL-IR-S1  1.00 IRI[illegible] SMALL PART                                          .02362                  .029
   0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                       .01001                  .012
0185        UP 01   24            .05                                I.V.D. ALUMINUM PLATE          .230    .003    .014  1.0   2
   0010 N                      1.00                                  I.V.D. PLATE                   .22000          .272
   0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                   .01001          .012
0190        UP 01   24            .05                                ALODINE I.V.D. ALUM PLATE      .230    .003    .014        2
   0010 N                      1.00                                  ALODINE                        .22000          .272
   0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                   .01001          .012
9000        UP 01   24            .01                                LABOR STANDARD HISTORY         .000    .000    .000        0
   0010                             14NOV84 2 YR REVIEW W/NO CHANGE
   0011                             18MAR85 DOWN GRADED NOT MARKET BASKET
   0012                             13NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD    .20
   0900                              J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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LABOR STANDARD OP[illegible]ION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]3/02/88 A-E046B-MM1-DY-M45 PAGE 0001
26337A F15 MLG R/H HM RCC MMPRC [illegible]4-22-3 86224

OPER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
07	S	N	UP	EA	B		J 88190	.33	PERCENT ENGR 79.8	TRUNNION PIN, F-15 MAIN	1.25		.41			
0001			UP	01		15		.00		PART NUMBER/ NSN	.000	.000	.000		0	
0010									68A410735-2001	1620003386529						
0034			UP	01		24		1.00		DEGREASE	.097	.023	.120		10	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0036			UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	13	
0010		E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0038			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01		24		.22		STRIP CHROME SMALL PART O.D.	.098	.005	.027	24.0	2	
0010		E					ZCR-ST-S2	.50	STRIP CHROME O.D. SMALL PARTOCC 2EA OPERATIONS		.17652		.109			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01		24		.22		STRIP CHROME SMALL PART O.D.	.098	.005	.027	24.0	2	
0010		E					ZCR-ST-S2	.50	STRIP CHROME O.D. SMALL PARTOCC. 2EA OPERATIONS		.17652		.109			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090			UP	01		24		.34		B[illegible]	.090	.007	.038	8.0	3	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0105			UP	01		24		.34		DEGREASE	.097	.008	.041		3	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110			UP	01		24		.34		SHOTPEEN SM STEEL PART/MASK	.278	.023	.117		9	
0010		E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0113			UP	01		24		.34		PREP FOR CHROME SM PART O.D.	.365	.030	.154		12	
0010		N						1.00		PREP FOR CHRMOE	.35500		.440			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0117			UP	01		24		.34		GRIT BLAST	.046	.004	.020		2	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120			UP	01		24		.22		CHROME PLATE SMALL PART O.D.	.155	.008	.042	24.0	3	
0010		N						.50		CHROME PLATE SMALL PART O.D.	.29000		.179			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		.22		CHROME PLATE SMALL PART O.D.	.155	.008	.042	24.0	3	
0010		N						.50		OCC. 2EA OPERATIONS	.29000		.179			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0135			UP	01		24		.34		BAKE AFTER CHROME PLATE	.090	.007	.038	8.0	3	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170			UP	01		24		.34		BAKE AFTER GRIND	.090	.007	.038	8.0	3	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0185			UP	01		24		.34		DEGREASE	.097	.008	.041		3	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0191			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		5	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

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 0192     UP 01   24         .95
    0010 E          ZPL-CD-S1  1.00 CA[illegible] PLATE SMALL PART                                  .09212          .114
    0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001          .012
 0196     UP 01   24         .95                          BAKE AFTER CAD PLATE            .090   .021     .107 38.0   9
    0010 E          ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                            .08088          .100
    0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001          .012
 0197     UP 01   24         .95                          CHROMATE CONVERSION(IRIDITE)    .033   .008     .040        3
    0010 E          ZPL-IR-S1  1.00 IRIDITE SMALL PART                                    .02362          .029
    0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001          .012
 0201     UP 01   24         .05                          I.V.D. ALUMINUM PLATE           .230   .003     .014  1.0   1
    0010 N                     1.00                       I.V.D. PLATE                    .22000          .272
    0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                         .01001          .012
 0203     UP 01   24         .05                          LABOR STANDARD HISTORY          .000   .000     .000        0
    0010                          14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <    .14
    0011                          18MAR85 DOWN GRADED NOT MARKET BASKET
    0012                          20NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD    .43
    0990                           J.CALDWELL TECH MANEAA
 9000     UP 01   24         .01                          LABOR STANDARD HISTORY          .000   .000     .000        0
    0010                          14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <    .14
    0011                          18MAR85 DOWN GRADED NOT MARKET BASKET
    0012                          20NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD    .43
    0990                           J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPE ION RESOURCE STANDARD AND METHOD ANALYSIS 2/02/88 A-E046B-MH1-BY-M45 PAGE 0001

26337A F15 MLG R/H HW RCC MMPRC • 4-22-3 86224

OPER SUB STEP	TECH T D	S S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
08	S	E	UP	EA	B	J 88189	.26	PERCENT ENGR 92.0	LOWER DRAG BRACE F-15M	.62		.16			
0001			UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000			0
0010								68A410792-1001	1620003654004						
0030			UP	01	24		1.00		DEGREASE	.097	.023	.120		19	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0035			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	26	
0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0037			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01	24		1.00		DEGREASE	.097	.023	.120		19	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0055			UP	01	24		1.00		GRIT BLAST	.046	.011	.058		9	
0010	E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060			UP	01	24		.05		CAD PLATE	.102	.001	.006		1	
0010	E					ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070			UP	01	24		.05		BAKE AFTER CAD PLATE	.090	.001	.006	38.0	1	
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0080			UP	01	24		.05		CHROMATE CONVERSION(IRIDITE)	.033	.000	.002		0	
0010	E					ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090			UP	01	24		.90		VAC CAD SMALL PART	.068	.015	.077	1.0	12	
0010	E					ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0092			UP	01	24		.90		HOT WATER RINSE	.030	.006	.033		5	
0010	N						1.00		HOT WATER RINSE	.02000		.024			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0094			UP	01	24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	2	
0010	N						1.00		I.V.D. PLATE	.22000		.272			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
0096			UP	01	24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		2	
0010	N						1.00		ALODINE	.22000		.272			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
9000			UP	01	24		.01		LABOR STANDARD HISTORY	.000	.000	.000		0	
0010								14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .03							
0011								18MAR85 DOWN GRADED NOT MARKET BASKET							
0012								19NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD .17							
0900								J.CALDWELL TECH MANEAA							

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 8/02/88 A-E046B-MM1-BY-M45 PAGE 000

26337A F15 MLG R/H HW RCC MMFRC 4-22-3 86224

OPER SUB	STEP	TECH	S T D / S K L	W F #R K	A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT
..009		S	E	UP	EA	B	J 88194	.07	PERCENT ENGR 90.6	JURY LINK PIN F-15M	.73		.05		
0001				UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000		0
	0010								68A410756-1001	1620003386530					
0024				UP	01	24		1.00		DEGREASE	.097	.023	.120		16
	0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0026				UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	22
	0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0028				UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	1
	0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0040				UP	01	24		.05		STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	2
	0010	E					ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0070				UP	01	24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1
	0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0085				UP	01	24		.05		DEGREASE	.097	.001	.006		1
	0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0090				UP	01	24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		2
	0010	E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101		
	0020	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200		
	0030	N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031		
	0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0093				UP	01	24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		3
	0010	N						1.00		PREP FOR CHRMOE	.35500		.440		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0097				UP	01	24		.05		GRIT BLAST	.046	.001	.003		0
	0010	E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0100				UP	01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	1
	0010	N						.50		OCC 2 EA OPERATIONS	.29000		.179		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0111				UP	01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	1
	0010	N						.50		OCC 2 EA OPERATIONS	.29000		.179		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0115				UP	01	24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1
	0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0130				UP	01	24		.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1
	0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0145				UP	01	24		.05		DEGREASE	.097	.001	.006		1
	0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0153				UP	01	24		1.00		GRIT BLAST	.046	.011	.058		8
	0010	E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0155				UP	01	24		.05		VAC CAD SMALL PART	.068	.001	.004	1.0	1
	0010	E					ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072		
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		

16009

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0160     UP 01   24        .90                    CAD PLATE                          .102   .022    .114        15
   0010 E        ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                             .09212         .114
   0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0170     UP 01   24        .90                    BAKE AFTER CAD PLATE               .090   .020    .101 38.0  14
   0010 E        ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                           .08088         .100
   0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0175     UP 01   24        .95                    CHROMATE CONVERSION(IRIDITE)       .033   .008    .040         5
   0010 E        ZPL-IR-S1  1.00 IRIDITE SMALL PART                                   .02362         .029
   0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001         .012
0183     UP 01   24        .05                    I.V.D. ALUMINUM PLATE              .230   .003    .014  1.0   2
   0010 N                   1.00                  I.V.D. PLATE                       .22000         .272
   0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                        .01001         .012
0187     UP 01   24        .05                    ALODINE I.V.D. ALUM PLATE          .230   .003    .014         2
   0010 N                   1.00                  ALODINE                            .22000         .272
   0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                        .01001         .012
9000     UP 01   24        .01                    LABOR STANDARD HISTORY             .000   .000    .000         0
   0010                          14NOV84 2 YR REVIEW W/NO CHANGE
   0011                          18MAR85 DOWN GRADED NOT MARKET BASKET
   0012                          13NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD     .20
   0900                           J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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1234567890123456  ELSE PUT IN END
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LABOR STANDARD OP[illegible]TION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]8/02/88 A-E046B-MM1-DY-M45 PAGE 0001

26337A F15 MLG R/H MW RCC MMPRC [illegible]4-22-3 86224

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OPER    TECH S S   W F PF A/R REV
 SUB       T K  #R A FA SUPPORT   OCC <------------------- DESCRIPTION ------------------->  BASE    PFD    STD          A
    STEP  D L    K C DC ELEMENT   FACT        STORED                 SUPPLEMENTAL           HOURS   TIME   HOURS  DLY PCT C
-------------------------------------------------------------------------------------------------------------------------
010    S  E UP EA B    J 88189    .10 PERCENT ENGR 99.9        F-15 MAIN LOWER JURY LINK     .36            .03
 0001      UP 01   00             .00                          PART NUMBER/NSN               .000   .000   .000          0
    0010                              68A410795-1003    1620010360263
 0030      UP 01   24             1.00                         STRIP ANODIZE MED PART        .136   .033   .169   .5  47
    0010 E           ZCD-ST-S1    1.00                         STRIP ANODIZE                 .12630        .156
    0020 E           RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001        .012
 0050      UP 01   24             1.00                         ANODIZE SMALL PART            .156   .037   .193   .8  53
    0010 E           RWB-CV-D1    1.00 VAPOR CL (DEGR)HOOK/BASKET                            .08709        .107
    0020 E           ZPL-AN-S1    1.00 ANODIZE SMALL PART                                    .05892        .073
    0030 E           RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001        .012
 9000      UP 01   24             .01                          LABOR STANDARD HISTORY        .000   .000   .000          0
    0010                              13SEP83 NEW INPUT-NO OCC FACTOR HISTORY
    0011                              14NOV84 2 YR REVIEW W/NO CHANGE
    0012                              18MAR85 DOWN GRADED NOT MARKET BASKET
    0013                              25NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD   .29
    0900                               J.CALDWELL TECH MANEAA
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TO INTERROGATE LABOR STANDARDS, INPUT

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 RCC PRD NROP NR
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30[illegible]

OPER SUB STEP	TECH S T D	S K L	W #R K	F A C	PF FA DC	A/R SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
J11	S E	UP	EA	B		J 88195	.81	PERCENT ENGR 91.5	UPPER JURY LINK F-15M	.81		.65			
0001		UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010								68A410794-1006	1620010403580						
0020								68A410794-1005	1620010403581						
0040		UP	01		24		1.00		DEGREASE	.097	.023	.120		15	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0042		UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	20	
0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0043		UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0045		UP	01		24		.05		STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	1	
0010	E					ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070		UP	01		24		.82		BAKE AFTER ETCH	.090	.018	.092	8.0	11	
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0085		UP	01		24		.82		DEGREASE	.097	.019	.099		12	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090		UP	01		24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		2	
0010	E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031			
0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0093		UP	01		24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		3	
0010	N						1.00		PREP FOR CHRMOE	.35500		.440			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0097		UP	01		24		.05		GRIT BLAST	.046	.001	.003		0	
0010	E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100		UP	01		24		.05		CHROME PLATE SMALL PART O.D.	.300	.004	.019	24.0	2	
0010	N						1.00		CHROME PLATE SMALL PART O.D.	.29000		.359			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110		UP	01		24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1	
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130		UP	01		24		.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1	
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0145		UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0155		UP	01		24		1.00		GRIT BLAST	.046	.011	.058		7	
0010	E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0160		UP	01		24		.23		CAD PLATE	.102	.006	.029		4	
0010	E					ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0162		UP	01		24		.72		VAC CAD SMALL PART	.068	.012	.061	1.0	8	
0010	E					ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072			

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  0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                    .01001             .012
0165     UP 01   24             .23                               BAKE AFTER CAD PLATE            .090   .005        .026 38.0   3
  0010 E          ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                                      .08088             .100
  0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                    .01001             .012
0170     UP 01   24             .95                               CHROMATE CONVERSION(IRIDITE)    .033   .008        .040        5
  0010 E          ZPL-IR-S1  1.00 IRIDITE SMALL PART                                              .02362             .029
  0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                    .01001             .012
0193     UP 01   24             .05                               I.V.D. ALUMINUM PLATE           .230   .003        .014  1.0   2
  0010 M                     1.00                                 I.V.D. PLATE                    .22000             .272
  0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                   .01001             .012
0197     UP 01   24             .05                               ALODINE I.V.D. ALUM PLATE       .230   .003        .014        2
  0010 M                     1.00                                 ALODINE                         .22000             .272
  0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                   .01001             .012
9000     UP 01   24             .01                               LABOR STANDARD HISTORY          .000   .000        .000        0
  0010                            09MAY84ADD OP 0025 OCC EST <OLD STD>        02840
  0011                            14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <  2.90
  0012                            18MAR85 DOWN GRADED NOT MARKET BASKET
  0013                            19NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD   .83
  0900                             J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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LABOR STANDARD OP[illegible]TION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]3/02/88 A-E046B-MM1-DY-M45 PAGE 0001

26337A F15 MLG R/H HW RCC MMPRC [illegible]4-22-3 86224

OPER SUB STEP	TECH	S T D	S K L	W F #R K	A C	PF FA DC	A/R SUPPORT ELEMENT	OCC FACT	STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
12	S	N	UP	EA	B	J	88190	.05	PERCENT ENGR 67.9	RETRACT BOLT F-15 MAIN	2.68		.13			
0001			UP	01		15		.00		PART NUMBER/ NSN	.000	.000	.000		0	
0010									68A410768-1001	1620003386550						
0030			UP	01		24		1.00		DEGREASE	.097	.023	.120		4	
0010	E						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0035			UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	6	
0010	E						ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	0	
0010	E						ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01		24		1.00		STRIP CHROME SMALL PART O.D.	.186	.045	.231	24.0	9	
0010	E						ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090			UP	01		24		1.00		BAKE AFTER ETCH	.090	.022	.113	8.0	4	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0105			UP	01		24		1.00		DEGREASE	.097	.023	.120		4	
0010	E						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110			UP	01		24		1.00		SHOTPEEN SM STEEL PART/MASK	.278	.067	.345		13	
0010	E						ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020	E						RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	N						ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031			
0040	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120			UP	01		24		1.00		PREP FOR CHROME SM PART O.D.	.365	.088	.453		17	
0010	N							1.00		PREP FOR CHRMOE	.35500		.440			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0125			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		2	
0010	E						RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		1.00		CHROME PLATE SMALL PART O.D.	.300	.072	.372	24.0	14	
0010	N							1.00		CHROME PLATE SMALL PART O.D.	.29000		.359			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0140			UP	01		24		1.00		BAKE AFTER GRIND	.090	.022	.113	8.0	4	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170			UP	01		24		1.00		BAKE AFTER GRIND	.090	.022	.113	8.0	4	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0185			UP	01		24		1.00		DEGREASE	.097	.023	.120		4	
0010	E						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0195			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		2	
0010	E						RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0200			UP	01		24		.95		CAD PLATE	.102	.023	.120		4	
0010	E						ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0210			UP	01		24		.95		BAKE AFTER CAD PLATE	.090	.021	.107	38.0	4	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

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0215      UP 01   24         .95                          [illegible]                      [illegible]  [illegible]  [illegible]
   0010 E         ZPL-IR-S1  1.00 IR[illegible]E SMALL PART                                    .02362           .029
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001           .012
0223      UP 01   24         .05                          I.V.D. ALUMINUM PLATE            .230   .003      .014  1.0   1
   0010 N                    1.00                         I.V.D. PLATE                     .22000           .272
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                .01001           .012
0227      UP 01   24         .05                          ALODINE I.V.D. ALUM PLATE        .230   .003      .014        1
   0010 N                    1.00                         ALODINE                          .22000           .272
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                .01001           .012
9000      UP 01   24         .01                          LABOR STANDARD HISTORY           .000   .000      .000        0
   0010                           14NOV84 2 YR REVIEW W/NO CHANGE
   0011                           18MAR85 DOWN GRADED NOT MARKET BASKET
   0012                           19NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD   .14
   0900                            J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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1234567890123456  ELSE PUT IN END
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26337A F15 MLG R/H HW RCC MMPRC [illegible]n4-22-3 86224

OPER SUB STEP	TECH S TD S KL W RK F AC	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
13	S E UP EA B		J 88197	.15	PERCENT ENGR 85.3	SPINDLE ASSY F-15M	.61		.09			
0001	UP 01	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010					68A410624-1001	1620003337133						
0024	UP 01	24		1.00		DEGREASE	.097	.023	.120		19	
0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026	UP 01	24		.95		STRIP CAD	.136	.031	.161	.5	26	
0010	E		ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028	UP 01	24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010	E		ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040	UP 01	24		.05		PREP FOR CHROME SM PART O.D.	.187	.002	.012		2	
0010	N			.50		OCC 2 EA OPERATIONS	.35500		.220			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050	UP 01	24		.05		PREP FOR CHROME SM PART O.D.	.187	.002	.012		2	
0010	N			.50		OCC 2 EA OPERATIONS	.35500		.220			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090	UP 01	24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100	UP 01	24		.05		DEGREASE	.097	.001	.006		1	
0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110	UP 01	24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		3	
0010	E		ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	N		ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031			
0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0113	UP 01	24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		4	
0010	N			1.00		PREP FOR CHRMOE	.35500		.440			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0117	UP 01	24		.05		GRIT BLAST	.046	.001	.003		0	
0010	E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120	UP 01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	2	
0010	N			.50		OCC 2 EA OPERATIONS	.29000		.179			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130	UP 01	24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	2	
0010	N			.50		OCC 2 EA OPERATIONS	.29000		.179			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0140	UP 01	24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1	
0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170	UP 01	24		.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1	
0010	E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0177	UP 01	24		.05		DEGREASE	.097	.001	.006		1	
0010	E		RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0181	UP 01	24		1.00		GRIT BLAST	.046	.011	.058		9	
0010	E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

36013

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0183     UP 01   24          .90                           VAC CAD SMALL PART          [illegible] [illegible]   [illegible]
   0010 E         ZPL-VC-S1  1.00 VAC[illegible]D PLATE SMALL PART                     .05856          .072
   0020 E         RJP-PW-R1  1.00 REM [illegible]PL PAPRWRK SIGN OFF DOC               .01001          .012
0185     UP 01   24          .05                           CAD PLATE                   .102   .001     .006         1
   0010 E         ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                             .09212          .114
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001          .012
0187     UP 01   24          .05                           BAKE AFTER CAD PLATE        .090   .001     .006 38.0    1
   0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                           .08088          .100
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001          .012
0191     UP 01   24          .95                           CHROMATE CONVERSION(IRIDITE) .033  .008     .040         6
   0010 E         ZPL-IR-S1  1.00 IRIDITE SMALL PART                                   .02362          .029
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                         .01001          .012
0193     UP 01   24          .05                           I.V.D. ALUMINUM PLATE       .230   .003     .014 1.0     2
   0010 N                    1.00                          I.V.D. PLATE                .22000          .272
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                        .01001          .012
0195     UP 01   24          .05                           ALODINE I.V.D. ALUM PLATE   .230   .003     .014         2
   0010 N                    1.00                          ALODINE                     .22000          .272
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                        .01001          .012
9000     UP 01   00          .00                           LAOBR STANDARD HISTORY      .000   .000     .000         0
   0001                           15 JUL 88            INITIAL INPUT
   0900                           KIM VINCENT, MANEL, 73255


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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1234567890123456  ELSE PUT IN END
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LABOR STANDARD OP[illegible]TION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]9/02/88 A-E046B-MM1-BY-M45 PAGE 0001

26337A F15 MLG R/H HW RCC MNPRC [illegible]4-22-3 86224

OPER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
:014	S	E	UP	EA	B		J 88196	.48	PERCENT ENGR 87.7	SWIVEL CRANK DRAG BOLT F-15M	.76		.36			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									68A410637-1001 NSL							
0024			UP	01		24		1.00		DEGREASE	.097	.023	.120		16	
0010	E						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026			UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	21	
0010	E						ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010	E						ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01		24		.08		STRIP CHROME SMALL PART O.D.	.186	.004	.019	24.0	2	
0010	E						ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070			UP	01		24		.08		BAKE AFTER ETCH	.090	.002	.009	8.0	1	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0080			UP	01		24		.08		DEGREASE	.097	.002	.010		1	
0010	E						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090			UP	01		24		.08		SHOTPEEN SM STEEL PART/MASK	.278	.005	.028		4	
0010	E						ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020	E						RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	N						ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031			
0040	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0093			UP	01		24		.08		PREP FOR CHROME SM PART O.D.	.365	.007	.036		5	
0010	N							1.00		PREP FOR CHRMOE	.35500		.440			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0097			UP	01		24		.08		GRIT BLAST	.046	.001	.005		1	
0010	E						RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01		24		.08		CHROME PLATE SMALL PART O.D.	.300	.006	.030	24.0	4	
0010	N							1.00		CHROME PLATE SMALL PART O.D.	.29000		.359			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110			UP	01		24		.08		BAKE AFTER CHROME PLATE	.090	.002	.009	8.0	1	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		.08		BAKE AFTER GRIND	.090	.002	.009	8.0	1	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0145			UP	01		24		.08		DEGREASE	.097	.002	.010		1	
0010	E						RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0155			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		8	
0010	E						RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0160			UP	01		24		.95		CAD PLATE	.102	.023	.120		16	
0010	E						ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170			UP	01		24		.95		BAKE AFTER CAD PLATE	.090	.021	.107	38.0	14	
0010	E						ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E						RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

36014

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 0183       UP 01   24             .05                                  I.V.D. ALUMINUM PLATE           .230    .003      .014   1.0   2
    0010 N                        1.00                                  I.V.D. PLATE                    .22000            .272
    0020 E            RJP-PW-R1   1.00 REM RPL PAPRWRK SIGN OFF DOC/                                    .01001            .012
 0187       UP 01   24             .05                                  ALODINE I.V.D. ALUM PLATE       .230    .003      .014          2
    0010 N                        1.00                                  ALODINE                         .22000            .272
    0020 E            RJP-PW-R1   1.00 REM RPL PAPRWRK SIGN OFF DOC/                                    .01001            .012
 0000       UP 01   00             .00                                  LABOR STANDARD HISTORY          .000    .000      .000          0
    0010                                14 JUL 88          INITIAL INPUT
    0900                                KIM VINCENT, MANEL, 73255


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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LABOR STANDARD OP[illegible]TION RESOURCE STANDARD AND METHOD ANALYSIS [illegible]3/02/88 A-E046B-MM1-DY-M45 PAGE 0001

26337A F15 MLG R/H MW RCC MMPRC m4-22-3 86224

OPER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R SUPPORT ELEMENT	REV OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
116	S	E	UP	EA	B		J 88196	.63	PERCENT ENGR 94.6	COLLAR ASSY F-15M	.53		.33			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									68A410733-1001	1620003386559						
0020									68A410733-1002	1620003386559						
0024			UP	01		24		1.00		DEGREASE	.097	.023	.120		22	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026			UP	01		24		.95		STRIP CAD	.136	.031	.161	.5	30	
0010		E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	2	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0080			UP	01		24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0095			UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01		24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		3	
0010		E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0105			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		11	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110			UP	01		24		.12		CAD PLATE	.102	.003	.015		3	
0010		E					ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120			UP	01		24		.83		VAC CAD SMALL PART	.068	.014	.071	1.0	13	
0010		E					ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		.05		BAKE AFTER CAD PLATE	.090	.001	.006	38.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0135			UP	01		24		.95		CHROMATE CONVERSION(IRIDITE)	.033	.008	.040		7	
0010		E					ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0137			UP	01		24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	3	
0010		N						1.00		I.V.D. PLATE	.22000		.272			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
0138			UP	01		24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		3	
0010		N						1.00		ALODINE	.22000		.272			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
9000			UP	01		24		.01		LABOR STANDARD HISTORY	.000	.000	.000		0	
0010									14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD < .04							
0011									18MAR85 DOWN GRADED NOT MARKET BASKET							
0012									18NOV85 CHANGED SUBOPS TO MATCH 958 OLD STD .45							
0013									25AUG85 SUBOP 0080 NEW REQ. OLD STANDARD .42							
0900									J.CALDWELL TECH MANEAA							

36016

26337A   F15 MLG R/H HW   RCC MNPRC   m4-22-3   86224

OPER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
...019	S	E	UP	EA	B		J 88190	.07	PERCENT ENGR 88.6	JURY BRACE APEX PIN,F15 MAIN	.60		.04			
0001			UP	01		15		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									68A410755-2005	1620003337138						
0024			UP	01		24		1.00		DEGREASE	.097	.023	.120		20	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026			UP	01		24		.95		STRIP CAD	.134	.031	.161	.5	26	
0010		E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028			UP	01		24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0030			UP	01		24		.05		STRIP CHROME SMALL PART O.D.	.186	.002	.012	24.0	2	
0010		E					ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART		.17652		.218			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070			UP	01		24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0085			UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0090			UP	01		24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		3	
0010		E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0093			UP	01		24		.05		PREP FOR CHROME SM PART O.D.	.365	.004	.023		4	
0010		N						1.00		PREP FOR CHRMOE	.35500		.440			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0097			UP	01		24		.05		GRIT BLAST	.046	.001	.003		0	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01		24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	2	
0010		N						.50		CHROME PLATE SMALL PART O.D.	.29000		.179			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0105			UP	01		24		.05		CHROME PLATE SMALL PART O.D.	.155	.002	.010	24.0	2	
0010		N						.50		CHROME PLATE SMALL PART O.D.	.29000		.179			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0110			UP	01		24		.05		BAKE AFTER CHROME PLATE	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130			UP	01		24		.05		BAKE AFTER GRIND	.090	.001	.006	8.0	1	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0145			UP	01		24		.05		DEGREASE	.097	.001	.006		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0153			UP	01		24		1.00		GRIT BLAST	.046	.011	.058		10	
0010		E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0155			UP	01		24		.90		VAC CAD SMALL PART	.068	.015	.077	1.0	13	
0010		E					ZPL-VC-S1	1.00	VAC CAD PLATE SMALL PART		.05856		.072			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

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0160      UP 01   24          .05                               CAD PLATE                    .102   .001     .006        1
    0010 E        ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                                   .09212          .114
    0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001          .012
0170      UP 01   24          .05                               BAKE AFTER CAD PLATE         .090   .001     .006 38.0   1
    0010 E        ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                                 .08088          .100
    0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001          .012
0175      UP 01   24          .95                               CHROMATE CONVERSION(IRIDITE) .033   .008     .040        7
    0010 E        ZPL-IR-S1  1.00 IRIDITE SMALL PART                                         .02362          .029
    0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001          .012
0183      UP 01   24          .05                               I.V.D. ALUMINUM PLATE        .230   .003     .014  1.0   2
    0010 N                   1.00                               I.V.D. PLATE                 .22000          .272
    0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                              .01001          .012
0187      UP 01   24          .05                               ALODINE I.V.D. ALUM PLATE    .230   .003     .014        2
    0010 N                   1.00                               ALODINE                      .22000          .272
    0020 E        RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                              .01001          .012
9000      UP 01   24          .01                               LABOR STANDARD HISTORY       .000   .000     .000        0
    0010                          13SEP83 NEW INPUT-NO OCC FACTOR HISTORY
    0011                          14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <   .28
    0012                          18MAR85 DOWN GRADED NOT MARKET BASKET
    0013                          26NOV85 CHANGED SUBOPS TO MATCH 958  OLD STD   .19
    0900                           J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS, INPUT

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                 LABOR STANDARD OP[illegible]ION RESOURCE STANDARD AND METHOD ANALYSIS  [illegible]/02/88   A-E046B-MM1-DY-M45  PAGE  0001
          26337A    F15 MLG R/H MW                         RCC MNPRC                  [illegible]4-22-3   [illegible]        86224
OPER    TECH S S    W F PF A/R REV
  SUB       T K   #R A FA SUPPORT   OCC <------------- -------- DESCRIPTION -------------------->  BASE    PFD    STD            A
     STEP D L      K C DC ELEMENT  FACT           STORED                    SUPPLEMENTAL            HOURS   TIME   HOURS   DLY PCT C
---------------------------------------------------------------------------------------------------------------------------------
 20      S  E UP EA D    J 88196   .82 PERCENT ENGR 88.9              SPRING F-15M                   .92           .75
 0001       UP 01   00             .00                                PART NUMBER/NSN                .000   .000   .000          0
     0010                              68A410725-1001       1620001323253
     0020                              68A410725-1002      1620001323209
 0050       UP 01   24            1.00                                DEGREASE                       .184   .044   .228         25
     0010 E          RWB-CV-D1    2.00 VAPOR CL (DEGR)HOOK/BASKET     OCC 2 EA PARTS                 .08709        .215
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001        .012
 0060       UP 01   24             .95                                STRIP CAD                      .262   .060   .309   .5   34
     0010 E          ZCD-ST-S1    2.00 STRIP CAD PLATE SMALL PART     OCC 2 EA PARTS                 .12630        .313
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001        .012
 0070       UP 01   24             .05                                STRIP RUST                     .262   .003   .016   .3    2
     0010 E          ZCD-ST-S1    2.00                                OCC 2 EA PARTS                 .12630        .313
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001        .012
 0080       UP 01   24            1.00                                GRIT BLAST                     .083   .020   .103         11
     0010 E          RWB-CB-B1    2.00 BLAST SM PT OR BSKT V/SM PTSOCC 2 EA PARTS                    .03668        .090
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001        .012
 0090       UP 01   24             .95                                VAC CAD SMALL PART             .127   .029   .150  1.0   16
     0010 E          ZPL-VC-S1    2.00 VAC CAD PLATE SMALL PART       OCC 2 EA PARTS                 .05856        .145
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001        .012
 0100       UP 01   24             .95                                HOT WATER RINSE                .050   .011   .059          6
     0010 N                       2.00                                OCC 2 EA PARTS                 .02000        .049
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001        .012
 0110       UP 01   24             .05                                I.V.D. ALUMINUM PLATE          .450   .005   .028  1.0    3
     0010 N                       2.00                                OCC 2 EA PARTS                 .22000        .545
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                                 .01001        .012
 0120       UP 01   24             .05                                ALODINE I.V.D. ALUM PLATE      .450   .005   .028          3
     0010 N                       2.00                                OCC 2 EA PARTS                 .22000        .545
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                                 .01001        .012
 9000       UP 01   24             .01                                LABOR STD HISTORY              .000   .000   .000          0
     0010                              13SEP83 NEW INPUT-NO OCC FACTOR HISTORY
     0011                              14NOV84 2 YR REVIEW W/OCC CHANGE > OLD STD <   .02
     0012                              18NOV85 CHANGED DROPED DRY FILM NOT REQ OLD STD.18
     0900                              J.CALDWELL TECH MANEAA


TO INTERROGATE LABOR STANDARDS. INPUT

 RCC PRD NROP NR
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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 05/26/89 A-E0463-MM1-DY-445 PAGE 0001

26337A F15 MLG R/H HW RCC MNPRC 4A4-22-3 86224

OPER SUB STEP	TECH T D / S X L / W R K / F A C / PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
0022	S E UP EA B	J 68202	1.00	PERCENT ENGR 92.1	PLATE COLLAR TRUNNION F-15M	.76		.76			
0001	UP 01 00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010				68A410638-1010	1620010753564						
0020				68A410638-1006	1620010381637						
0030	UP 01 24		1.00		DEGREASE	.097	.023	.120		16	
0010 E		RWB-CV-B1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040	UP 01 24		.95		STRIP CAD	.136	.031	.161	.5	21	
0010 E		ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050	UP 01 24		.05		STRIP RUST	.136	.002	.008	.3	1	
0010 E		ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120	UP 01 24		.05		BAKE AFTER ETCH	.090	.001	.006	8.0	1	
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0140	UP 01 24		.05		DEGREASE	.097	.001	.006		1	
0010 E		RWB-CV-B1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
[illegible]	UP 01 24		.05		SHOTPEEN SM STEEL PART/MASK	.278	.003	.017		2	
0010 E		ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020 E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030 N		ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031			
0040 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0160	UP 01 24		1.00		SHOTPEEN SM STEEL PART/MASK	.278	.067	.345		45	
0010 E		ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020 E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030 N		ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART		.05067		.031			
0040 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0260	UP 01 24		1.00		GRIT BLAST	.046	.011	.058		9	
0010 E		RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0270	UP 01 24		.05		CAD PLATE	.102	.001	.006		1	
0010 E		ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART		.09212		.114			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0280	UP 01 24		.05		BAKE AFTER CAD PLATE	.090	.001	.006	38.0	1	
0010 E		ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0290	UP 01 24		.05		CHROMATE CONVERSION(IRIDITE)	.033	.000	.002		0	
0010 E		ZPL-IR-S1	1.00	IRIDITE SMALL PART		.02362		.029			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0330	UP 01 24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	2	
0010 N			1.00		I.V.D. PLATE	.22000		.272			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
[illegible]40	UP 01 24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		2	
0010 N			1.00		ALODINE	.22000		.272			
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
9000	UP 01 00		1.00		LABOR STANDARD HISTORY	.000	.000	.000		0	
0001				2 AUGUST 88 INITIAL INPUT/NEW WORKLOAD							

0010
0800
0900

KERRY COOP MANEL 7-3357
22 MAR 89 INITIAL INPUT MRP II
ALBERT HARWOOD MANEL 7-3783

TO INTERROGATE LABOR STANDARDS, INPUT

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26337A F15 MLG R/H HW RCC MMPRC [illegible]4-22-3 86224

OPER SUB STEP	TECH T D	S S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
..026	E	N UP	EA	B		J 88202	.05	PERCENT ENGR 48.7	HIGH PRESSURE PISTON F15M	5.56		.27			
0001		UP	01		00		.00		PART NUMBER/N.S.N.	.000	.000	.000		0	
0010								68A410790-2001 1620003654003							
0024		UP	01		24		1.00		DEGREASE	.097	.023	.120		2	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0026		UP	01		24		.95		DEGREASE	.097	.022	.114		2	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0028		UP	01		24		.05		DEGREASE	.097	.001	.006		0	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0030		UP	01		24		1.00		STRIP CHROME SMALL PART O.D.	.070	.017	.087	24.0	2	
0010	E					ZCR-ST-S2	.34	STRIP CHROME O.D. SMALL PART	OCC. 3EA. OPERATIONS	.17652		.074			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040		UP	01		24		1.00		STRIP CHROME SMALL PART I.D.	.092	.022	.115	24.0	2	
0010	E					ZCR-ST-S1	.34	STRIP CHROME I.D.SMALL PART	OCC. 3EA. OPERATIONS	.24234		.102			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0045		UP	01		24		1.00		STRIP CHROME SMALL PART I.D.	.092	.022	.115	24.0	2	
0010	E					ZCR-ST-S1	.34	STRIP CHROME I.D.SMALL PART	OCC. 3EA. OPERATIONS	.24234		.102			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050		UP	01		24		1.00		STRIP NICKEL SMALL PART	.131	.031	.163	40.0	3	
0010	E					ZCR-ST-S1	.50		OCC. 2EA. OPERATIONS	.24234		.150			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060		UP	01		24		1.00		STRIP NICKEL SMALL PART	.131	.031	.163	40.0	3	
0010	E					ZCR-ST-S1	.50		OCC. 2EA. OPERATIONS	.24234		.150			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120		UP	01		24		1.00		BAKE AFTER ETCH	.090	.022	.113	8.0	2	
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0135		UP	01		24		1.00		DEGREASE	.097	.023	.120		2	
0010	E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0140		UP	01		24		1.00		SHOTPEEN SM STEEL PART/MASK	.278	.067	.345		6	
0010	E					ZMA-CP-S2	1.00	MASK SMALL COMPONENT PART		.08183		.101			
0020	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030	N					ZUM-CL-02	.50	UNMASK MEDIUM SIZE CYL PART	OCC 50% FOR SMALL PART	.05067		.031			
0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0143		UP	01		24		1.00		PREP FOR CHROME SM PART O.D.	.365	.088	.453		8	
0010	N						1.00		PREP FOR CHRMOE	.35500		.440			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0147		UP	01		24		1.00		GRIT BLAST	.046	.011	.058		1	
0010	E					RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0150		UP	01		24		1.00		CHROME PLATE SMALL PART O.D.	.300	.072	.372	24.0	7	
0010	N						1.00		CHROME PLATE SMALL PART O.D.	.29000		.359			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0155		UP	01		24		1.00		BAKE AFTER CHROME PLATE	.090	.022	.113	8.0	2	
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE		.08088		.100			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0157		UP	01		24		1.00		PREP FOR CHROME SM PART I.D.	.480	.115	.595		11	
0010	N						1.00		PREP CHROME I.D.	.47000		.582			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

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0158	UP 01	24		1.00	GRIT BLAST	.046	.011	.058		1
0010 E			RWB-CB-B1	1.00	BLAS[illegible]M PT OR BSKT V/SM PTS	.03668		.045		
0020 E			RJP-PW-R1	1.00	REM [illegible] PAPRWRK SIGN OFF DOC	.01001		.012		
0160	UP 01	24		1.00	CHROME PLATE SMALL PART I.D.	.330	.079	.409	30.0	7
0010 N				1.00	CHROME PLATE SMALL PART	.32000		.396		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0170	UP 01	24		1.00	BAKE AFTER CHROME PLATE	.090	.022	.113	8.0	2
0010 E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0200	UP 01	24		.25	BAKE AFTER GRIND	.090	.005	.028	8.0	1
0010 E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0203	UP 01	24		1.00	PREP FOR NICKEL	.160	.038	.198		4
0010 N				1.00	PREP FOR NICKEL SMALL PART	.15000		.186		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0207	UP 01	24		1.00	GRIT BLAST	.046	.011	.058		1
0010 E			RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0210	UP 01	24		1.00	NICKEL	.270	.065	.335	24.0	6
0010 N				1.00	NICKEL PLATE SMALL PART	.26000		.322		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0214	UP 01	24		1.00	BAKE AFTER NICKEL	.090	.022	.113	38.0	2
0010 E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0216	UP 01	24		1.00	PREP FOR NICKEL	.160	.038	.198		4
0010 N				1.00	PREP FOR NICKEL SMALL PART	.15000		.186		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0218	UP 01	24		1.00	GRIT BLAST	.046	.011	.058		1
0010 E			RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0220	UP 01	24		1.00	NICKEL	.270	.065	.335	24.0	6
0010 N				1.00	NICKEL PLATE SMALL PART	.26000		.322		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0230	UP 01	24		1.00	BAKE AFTER NICKEL	.090	.022	.113	38.0	2
0010 E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0255	UP 01	24		.25	BAKE AFTER GRIND	.090	.005	.028	8.0	1
0010 E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0265	UP 01	24		1.00	DEGREASE	.097	.023	.120		2
0010 E			RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET	.08709		.107		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0275	UP 01	24		1.00	GRIT BLAST	.046	.011	.058		1
0010 E			RWB-CB-B1	1.00	BLAST SM PT OR BSKT V/SM PTS	.03668		.045		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0280	UP 01	24		.95	CAD PLATE	.102	.023	.120		2
0010 E			ZPL-CD-S1	1.00	CADMIUM PLATE SMALL PART	.09212		.114		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0290	UP 01	24		.95	BAKE AFTER CAD PLATE	.090	.021	.107	38.0	2
0010 E			ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	.08088		.100		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0295	UP 01	24		.95	CHROMATE CONVERSION(IRIDITE)	.033	.008	.040		1
0010 E			ZPL-IR-S1	1.00	IRIDITE SMALL PART	.02362		.029		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0303	UP 01	24		.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	0
0010 N				1.00	I.V.D. PLATE	.22000		.272		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
0307	UP 01	24		.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0
0010 N				1.00	ALODINE	.22000		.272		
0020 E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		

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 9000      UP 00   24          .01                     LABOR STANDARD HISTORY          .000   .000    .000      0
    0001                            28W   INITAL INPUT ESTAMATE TIME NEW WORK REQUI
    0900                                        J.CALDWELL TECH MANEL
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INTERROGATE LABOR STANDARDS, INPUT

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 RCC PRD NROP NR
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1234567890123456  ELSE PUT IN END
?
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                    LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS  02/01/88   A-E046B-MM1-DY-M45  PAGE  0001
      74521A     STRUT ASSY C-141 MLG                          RCC MNPRC             4S2-59-3              81174
     TECH S S   W F PF A/R REV
  SUB      T K  #R A FA SUPPORT  OCC <------------------ DESCRIPTION ------------------>  BASE   PFD    STD         A
     STEP D L    K C DC ELEMENT  FACT            STORED                  SUPPLEMENTAL       HOURS  TIME   HOURS   DLY PCT C
-----------------------------------------------------------------------------------------------------------------------------
XNPRC     S  X UP EA B    J 84194  1.00 PERCENT ENGR 99.9          PLATE MISC STRUT PARTS   407    .64           .64
  0001       UP 01   00            .00                             PART NUMBER/NSN                 .000   .000   .000         0
     0010                              3660005-141           1620001877445
  0010       UP 01   24           1.00                             ALL PLATING PROCESSES           .519   .125   .644       100
     0010 E             ZPL-MS-S1 1.00 PLATE MISC PARTS AVGE STRUT                                 .51947        .644
     0900                              <
  9000       UP 01   24            .01                             LABOR STANDARD HISTORY          .000   .000   .000         0
     0010                               PRIOR HISTORY ON OO-ALC 494 FORM
     0020                              27JUN83 UPDATE OPERATION       <OLD STD>        .60
     0021                              27DEC84 2 YR REVIEW W/ NO CHANGE
     0900                              JENSEN              MANEL                 73255


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
<--->X<---->X<--->
1234567890123456  ELSE PUT IN END
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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 02/01/88 A-E046B-MM1-DY-M45 PAGE 0001

74521A STRUT ASSY C-141 NLG RCC MNPRC 4S2-59-3 81174

SUB STEP	TECH T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC501	S	N	UP	EA	B	J 84194	1.00	PERCENT ENGR 67.9	PLATE OUTER CYL C141 NLG 407	3.58		3.58			
0001			UP	00	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010								3G61090-119	1620004419763						
0055			UP	01	24		1.00		DEGREASE	.115	.028	.143		4	
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	4	
0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0065			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	0	
0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0071			UP	01	24		.05		REMOVE METAL SPRAY	.326	.004	.020		1	
0010	E					RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST		.31693		.392			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0072			UP	01	24		.05		BAKE 4 HRS	.171	.002	.011	8.0	0	
0010	E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0076			UP	01	24		.05		DEGREASE	.115	.001	.007		0	
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0078			UP	01	24		.39		STRIP CHROME FROM TRUNNION	.098	.009	.048	24.0	1	
0010	E					ZCR-ST-M2	.25	STRIP CHROME OD MED/LRG PART	4 EA AREAS AT A TIME	.35303		.109			
0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0080			UP	01	24		.50		STRIP CHROME FROM COLLAR	.098	.012	.061	24.0	2	
0010	E					ZCR-ST-M2	.25	STRIP CHROME OD MED/LRG PART	4 EA AREAS AT A TIME	.35303		.109			
0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0090			UP	01	24		.05		STRIP CHROME UPPER BORE	.098	.001	.006	24.0	0	
0010	E					ZCR-ST-M2	.25	STRIP CHROME OD MED/LRG PART	4 EA AREAS AT A TIME	.35303		.109			
0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0100			UP	01	24		.11		STRIP CHROME LOWER BORE	.098	.003	.013		0	
0010	E					ZCR-ST-M2	.25	STRIP CHROME OD MED/LRG PART	4 EA AREAS AT A TIME	.35303		.109			
0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0290			UP	01	24		.89		BAKE AFTER ETCH	.171	.037	.190	8.0	5	
0010	E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0305			UP	01	24		.05		DEGREASE	.115	.001	.007		0	
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0310			UP	01	24		.39		SHOTPEEN ALL SURFACES	.035	.003	.017		0	
0010	E					RPL-SP-M1	.16	SHOT PEEN SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.032			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0315			UP	01	24		.22		SHOTPEEN FILLER PLUG HOLE	.032	.002	.009		0	
0010	E					RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0320			UP	01	24		.44		SHOTPEEN TRUNION JOURNALS	.032	.003	.018		0	
0010	E					RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0330			UP	01	24		.50		SHOTPEEN FLANGE RADIUS	.032	.004	.020		1	
0010	E					RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0335			UP	01	24		.44		SHOTPEEN STEERING FLANGE	.032	.003	.018		0	
0010	E					RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART	7 EA AREAS AT A TIME	.16131		.028			

0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0340	UP 01	24	.56	SHOTPEEN COLLAR JOURNAL	.032	.004	.023		1
0010	E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART 7 EA AREAS AT A TIME	.16131		.028		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
v350	UP 01	24	.39	SHOTPEEN UPPER BORE	.032	.003	.016		0
0010	E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART 9 EA AREAS AT A TIME	.16131		.028		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0360	UP 01	24	.11	SHOTPEEN LOWER BORE	.032	.001	.004		0
0010	E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART 9 EA AREAS AT A TIME	.16131		.028		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0370	UP 01	24	.17	SHOTPEEN UPPER CHAMBER	.032	.001	.007		0
0010	E	RPL-SP-M1	.14	SHOT PEEN SMALL/MED PART 9 EA AREAS AT A TIME	.16131		.028		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0373	UP 01	24	.33	PREP FOR CHROME	.370	.029	.151		4
0010	N		1.00	PRORATED OVER 2 PREPS	.36000		.446		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0377	UP 01	24	.33	GRIT BLAST FOR CHROME	.060	.005	.025		1
0010	E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN BPRORATED OVER 2 BLASTS	.10180		.063		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0380	UP 01	24	.33	CHROME PLATE TRUN JRNLS	.305	.024	.125	24.0	3
0010				..					
0030	N		.50	CHROME PLATE	.59000		.365		
0040	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0383	UP 01	25	.28	PREP FOR CHROME	.720	.050	.252		7
0010	N		1.00	PREP FOR CHROME	.71000		.887		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0387	UP 01	24	.28	GRIT BLAST FOR CHROME	.060	.004	.021		1
0010	E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN B	.10180		.063		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
.390	UP 01	24	.28	CHROME PLATE COLLAR JOURNAL	.600	.040	.208	24.0	6
0030	N		1.00	CHROME PLATE	.59000		.731		
0040	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0395	UP 01	24	.33	BAKE AFTER CHROME	.090	.007	.037	8.0	1
0010	E	ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART ,	.16175		.100		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0397	UP 01	24	.33	PREP FOR CHROME	.365	.029	.149		4
0010	N		.50	PREP FOR CHROME	.71000		.440		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0398	UP 01	24	.33	GRIT BLAST FOR CHROME	.060	.005	.025		1
0010	E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN B	.10180		.063		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0400	UP 01	24	.33	CHROME PLATE UPPER BORE	.305	.024	.125	30.0	3
0030	N		.50	CHROME PLATE	.59000		.365		
0040	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0403	UP 01	24	.17	PREP FORM CHROME	.365	.015	.077		2
0010	N		.50	PREP FOR CHROME	.71000		.440		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0407	UP 01	24	.17	GRIT BLAST FOR CHROME	.060	.002	.013		0
0010	E	RPL-SB-M2	.50	SANDBLAST MED PART WALK-IN B	.10180		.063		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0410	UP 01	24	.17	CHROME PLATE LOWER BORE	.305	.012	.064	30.0	2
0030	N		.50	CHROME PLATE	.59000		.365		
0040	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
20	UP 01	24	.33	BAKE AFTER CHROME	.090	.007	.037	8.0	1
0010	E	ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART ,	.16175		.100		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0540	UP 01	24	.78	BAKE AFTER GRIND	.171	.032	.166	8.0	5
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART ,	.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0555	UP 01	24	.05	DEGREASE	.115	.001	.007		0

	0010 E		RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT PRORATED FOR SMALL PART	.14095		.131		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
566		UP 01	24	.05	BRUSH TEMPER ETCH	.105	.001	.007		0
	0010 E		RLG-RS-B1	1.00	BRUSH PLATE SPOT OR HOLE ,	.09546		.118		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0568		UP 01	24	.94	GRIT BLAST PRIOR TO CAD	.086	.019	.101		3
	0010 E		RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN BPRORATED SMALL PART	.10180		.094		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0570		UP 01	24	.94	CAD PLATE	.620	.140	.723		20
	0030 E		ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART ,	.61058		.757		
	0040 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0580		UP 01	24	.94	BAKE AFTER CAD	.171	.039	.200	38.0	6
	0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART ,	.16175		.200		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0585		UP 01	24	.94	IRIDITE	.106	.024	.124		3
	0010 E		ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST ,	.09635		.119		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0590		UP 01	24	1.00	BLAST TO REMOVE CORROSION	.092	.022	.115		3
	0010 E		ZLG-BC-03	1.00	BLAST CLEAN MED STRUT PART .,	.08290		.102		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,	.01001		.012		
0603		UP 01	24	.05	I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	0
	0010 N			1.00	I.V.D. PLATE	.22000		.272		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
0607		UP 01	24	.05	ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0
	0010 N			1.00	ALODINE	.22000		.272		
	0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		
9000		UP 01	24	.01	LABOR STANDARD HISTORY	.000	.000	.000		0
	0010				PRIOR HISTORY ON OO-ALC 494 FORM					
	0020				27JUN83 NEW OCC. FACTOR STUDY <OLD STD> 3.51					
	0021				27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD < 3.96					
	0022				8 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD 4.25					
	0023				27JAN88 STD CUT ORDER N.M.					
	0900				JENSEN MANEL 73255					

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR
<---X----X--->
1234567890123456 ELSE PUT IN END

74521A STRUT ASSY C-141 NLG RCC MNPRC 4S2-59-3 81174

SUB STEP	TECH S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC502	S	E	UP	EA	B	J 84194	.62	PERCENT ENGR 91.5	PLATE INNER CYL C141 NLG 407	3.21		1.99			
0001			UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000			0
0010								3G61089-111	1620004983226						
0035			UP	01	00		1.00		DEGREASE BEARING	.150	.000	.151			5
0040	E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.140			
0050	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.010			
0037			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5		5
0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3		0
0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0095			UP	01	24		.31		DEGREASE	.115	.009	.044			1
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0100			UP	01	24		.31		STRIP CHROME	.363	.027	.140	24.0		4
0010	E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART,		.35303		.437			
0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0104			UP	01	24		.05		STRIP CHROME	.363	.004	.023	24.0		1
0010	E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART,		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0108			UP	01	24		.05		STRIP CHROME	.363	.004	.023	24.0		1
0010	E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART,		.35303		.437			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0150			UP	01	24		.62		BAKE AFTER ETCH	.171	.026	.132	8.0		4
0010	E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0163			UP	01	24		.56		DEGREASE	.115	.016	.080			2
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0165			UP	01	24		.15		GLASS BLAST PISTON SEAL	.092	.003	.017			1
0010	E					ZLG-BC-03	1.00	BLAST CLEAN MED STRUT PART .,		.08290		.102			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0170			UP	01	24		.31		SHOTPEEN O.D.	.042	.003	.016			1
0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0180			UP	01	24		.05		SHOTPEEN PISTON UPPER END OD	.042	.001	.003			0
0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0190			UP	01	24		.20		SHOTPEEN METER, PIN HOLE I.D	.042	.002	.010			0
0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0200			UP	01	24		.33		SHOTPEEN AXLE ATT. LUG	.042	.003	.017			1
0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0215			UP	01	24		.15		SHOTPEEN ALL SURFACES	.042	.002	.008			0
0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0218			UP	01	24		.31		PREP CHROME PISTON OD.	.360	.027	.138			4
0010	N						1.00		PREP 2EA FACE SAME TIME	.35000		.434			
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0220			UP	01	24		.31		CHROME PLATE PISTON O.D.	1.314	.098	.505	24.0		16
0030	E					ZPL-CH-M2	1.00	CHROME PLATE MED/LRG PART-OD,		1.30401		1.616			

0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0225		UP 01	24		.31		BAKE AFTER CHROME	.171	.013	.066	8.0	2
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0228		UP 01	24		.05		PREP PISTON O.D FOR CHROME	.360	.004	.022		1
0010	N				1.00		PREP 2EA FACE SAME TIME	.35000		.434		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0230		UP 01	24		.05		CHROME PLATE PISTON O.D. UPP	.310	.004	.019	24.0	1
0030	N				1.00		CHROME PRORATED 2 CHROME OPS	.30000		.372		
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0235		UP 01	24		.05		BAKE AFTER CHROME	.171	.002	.011	8.0	0
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0238		UP 01	24		.08		PREP METERING PIN FOR CHROME	.360	.007	.036		1
0010	N				1.00		PREP 2EA FACE SAME TIME	.35000		.434		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0240		UP 01	24		.08		CHROME PLATE METR PIN I.D.	.410	.008	.041	30.0	1
0030	N				1.00		CHROME ID	.40000		.496		
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0250		UP 01	24		.08		BAKE AFTER CHROME	.171	.003	.017	8.0	1
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0290		UP 01	24		.31		BAKE AFTER GRIND	.171	.013	.066	8.0	2
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0305		UP 01	24		.05		DEGREASE	.115	.001	.007		0
0010	E			RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
[illegible]50		UP 01	24		.95		DEGREASE	.115	.026	.136		4
0010	E			RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0363		UP 01	24		.95		GRIT BLAST PRIOR TO CAD	.086	.020	.102		3
0010	E			RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN B	PRORATED SMALL PART	.10180		.094		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0365		UP 01	24		.95		CAD PLATE	.620	.141	.731		23
0010	E			ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART	CAD PLATE INNER CYL	.61058		.757		
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0370		UP 01	24		.95		BAKE AFTER CAD	.171	.039	.202	38.0	6
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0375		UP 01	24		.95		IRIDITE	.106	.024	.125		4
0010	E			ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	,	.09635		.119		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0383		UP 01	24		.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	0
0010	N				1.00		I.V.D. PLATE	.22000		.272		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0387		UP 01	24		.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		0
0010	N				1.00		ALODINE	.22000		.272		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0432		UP 01	24		.05		DEGREASE	.115	.001	.007		0
0010	E			RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0435		UP 01	24		.05		BRUSH PLATE REPAIR	.105	.001	.007		0
0010	E			RLG-RS-B1	1.00	BRUSH PLATE SPOT OR HOLE	,	.09546		.118		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0438		UP 01	24		.05		IRIDITE	.106	.001	.007		0
0010	E			ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	,	.09635		.119		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0440		UP 01	24		.85		BRUSH NICKEL PLATE	.105	.022	.111		3
0010	E			RLG-RS-B1	1.00	BRUSH PLATE SPOT OR HOLE	,	.09546		.118		

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    0020 E          RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                    .01001         .012
 9000       UP 01   24           .01                      LABOR STANDARD HISTORY                     .000   .000    .000          0
    0010                              PRIOR HISTORY ON OO-ALC 494 FORM
    0020                             27JUN83 NEW OCC. FACTOR STUDY  <OLD STD>      2.67
    0030                             26JUL83 NEW SUB OP.0025-OCC. EST <OLD STD>    2.92
    0031                             27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <  2.96
    0032                             7 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD   2.09
    0900                             JENSEN               MANEL                    73255


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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 02/01/88 A-E046B-MM1-DY-M45 PAGE 0001

74521A STRUT ASSY C-141 NLG RCC MNPRC 4S2-59-3 81174

JOB	STEP	T D	S K L	W #R K	F A C	PF FA DC	SUPPORT ELEMENT	OCC FACT	STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC503		S	E	UP	EA	B	J 84194	.93	PERCENT ENGR 81.9	PLATE AXLE C141 NLG 407	2.41		2.24			
0001				UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
	0010								3G61032-107 1620009272599							
0035				UP	01	24		1.00		DEGREASE	.115	.028	.143		6	
	0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040				UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	7	
	0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0045				UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	0	
	0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0080				UP	01	24		.36		STRIP CHM CNTR. JRNL. 3 EA	.130	.011	.058	24.0	2	
	0010	E					ZCR-ST-M2	.34	STRIP CHROME OD MED/LRG PART	3 EA AREAS AT A TIME	.35303		.148			
	0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0090				UP	01	24		.07		STRIP CHROME LRG. JRNL 2 EA	.126	.002	.011	24.0	0	
	0010	E					ZCR-ST-M2	.33	STRIP CHROME OD MED/LRG PART	3 EA AREAS AT A TIME	.35303		.144			
	0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0100				UP	01	24		.07		STRIOP CHROME SML JRNL 2 EA	.126	.002	.011	24.0	0	
	0010	E					ZCR-ST-M2	.33	STRIP CHROME OD MED/LRG PART	3 EA AREAS AT A TIME	.35303		.144			
	0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
160				UP	01	24		.50		BAKE AFTER ETCH	.171	.021	.106	8.0	4	
	0010	E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0175				UP	01	24		.05		DEGREASE	.115	.001	.007		0	
	0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0180				UP	01	24		.36		SHOTPEEN CENTER JRNLS 3 EA	.042	.004	.019		1	
	0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0190				UP	01	24		.07		SHOTPEEN LARGE JRNALS 2 EA	.042	.001	.004		0	
	0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0200				UP	01	24		.07		SHOTPEEN SMALL JOURNALS 2 EA	.042	.001	.004		0	
	0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0210				UP	01	24		.36		SHOTPEEN OUTER REWORK AREAS	.042	.004	.019		1	
	0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0212				UP	01	24		.29		SHOTPEEN CROSS BOLT HOLES	.042	.003	.015		1	
	0010	E					RPL-SP-M1	.20	SHOT PEEN SMALL/MED PART	5 EA AREAS AT A TIME	.16131		.040			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0215				UP	01	24		.05		PREP FOR CHROME	.720	.009	.045		2	
	0010	N						1.00		PREP FOR CHROME	.71000		.880			
	0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0220				UP	01	24		.36		CHROME PLATE CENTER JRNL 3EA	.600	.052	.268	24.0	11	
	0030	N						1.00		CHROME PLATE	.59000		.731			
	0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0230				UP	01	24		.07		CHROME LARGE JOURNALS 2 EA	.600	.010	.052	24.0	2	
	0030	N						1.00		CHROME PLATE	.59000		.731			
	0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
0240				UP	01	24		.07		CHROME SMALL JOURNALS 2 EA	.600	.010	.052	24.0	2	
	0030	N						1.00		CHROME PLATE	.59000		.731			

0040 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0250	UP 01	24	.43		BAKE AFTER CHROME	.171	.018	.092	8.0	4
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0290	UP 01	24	.43		BAKE AFTER GRIND	.171	.018	.092	8.0	4
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0305	UP 01	24	.05		DEGREASE	.115	.001	.007		0
0010 E		RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0315	UP 01	24	.96		GRIT BLAST PRIOR TO CAD	.086	.020	.103		4
0010 E		RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN B	PRORATED SMALL PART	.10180		.094		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0320	UP 01	24	1.00		CAD PLATE	.620	.149	.770		32
0030 E		ZPL-CD-M1	1.00	CADMIUM PLATE MEDIUM PART	,	.61058		.757		
0040 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0330	UP 01	24	1.00		BAKE AFTER CAD	.171	.041	.213	38.0	9
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0335	UP 01	24	1.00		IRIDITE	.106	.026	.132		5
0010 E		ZPL-IR-M1	1.00	IRIDITE MEDIUM PART-HOIST	,	.09635		.119		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0343	UP 01	24	.05		I.V.D. ALUMINUM PLATE	.230	.003	.014	1.0	1
0010 N			1.00		I.V.D. PLATE	.22000		.272		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0347	UP 01	24	.05		ALODINE I.V.D. ALUM PLATE	.230	.003	.014		1
0010 N			1.00		ALODINE	.22000		.272		
0020 E		RJP PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
00	UP 01	24	.01		LABOR STANDARD HISTORY	.000	.000	.000		0
0010				PRIOR HISTORY ON OO-ALC 494 FORM						
0020				27JUN83 NEW OCC FACTOR STUDY <OLD STD> 1.31						
0021				27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD < 1.33						
0022				8 OCT85 CHANGED SUBOPS TO MATCH 958 OLD STD .89						
0900				JENSEN MANEL 73255						

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 02/01/88 A-E046B-MM1-DY-M45 PAGE 0001

74521A STRUT ASSY C-141 MLG RCC MNPRC 4S2-59-3 81174

SUB STEP	TECH	T D	S K L	W #R K	F A C	PF FA DC	A/R SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC504	S	E	UP	EA	B		J 84194	.05	PERCENT ENGR 99.9	PLATE TRUNNION ASSY 407	1.13		.05			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									8340783-10	1620001947597						
0020									8340783-30	NSL						
0180			UP	01		24		1.00		DEGREASE TRUNNION	.150	.036	.187		16	
0005		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT<		.14095		.174			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0200			UP	01		24		1.00		SHOTPEEN TRUNION	.050	.012	.062		5	
0010		E					RPL-SP-M1	.25	SHOT PEEN SMALL/MED PART	OCC FOR 4 EA OPPERATIONS	.16131		.050			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0202			UP	01		24		1.00		SHOTPEEN CENTER ATT HOLE	.050	.012	.062		5	
0010		E					RPL-SP-M1	.25	SHOT PEEN SMALL/MED PART	OCC FOR 4 EA OPPERATIONS	.16131		.050			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0204			UP	01		24		.05		SHOTPEEN END TRUN SOCT RT.	.050	.001	.003		0	
0010		E					RPL-SP-M1	.25	SHOT PEEN SMALL/MED PART	OCC FOR 4 EA OPPERATIONS	.16131		.050			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0206			UP	01		24		.05		SHOTPEEN END TRUN SOCT RT.	.050	.001	.003		0	
0010		E					RPL-SP-M1	.25	SHOT PEEN SMALL/MED PART	OCC FOR 4 EA OPPERATIONS	.16131		.050			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0210			UP	01		24		1.00		HONE LARGE CENTER LUG	.104	.025	.129		11	
0010		E					RBW-SU-G1	.33	S/U FOR BENCH WORK GENERAL	PRO RATE 3 OPERATIONS	.27525		.112			
0020		E					RBW-BU-P1	1.00	BUTTERFLY POLISH BUSHING I D	POLISH/BUTTERFLY CENTER HOLE	.00333		.004			
0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0220			UP	01		24		.05		HONE TRUN END SOCKET <RIGHT>	.104	.001	.006		1	
0010		E					RBW-SU-G1	.33	S/U FOR BENCH WORK GENERAL	PRO RATE 3 OPERATIONS	.27525		.112			
0020		E					RBW-BU-P1	1.00	BUTTERFLY POLISH BUSHING I D	POL/BUTTERFLY TRUN END(RIGHT	.00333		.004			
0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0230			UP	01		24		.05		HONE TRUN END SOCKET <LEFT>	.104	.001	.006		1	
0010		E					RBW-SU-G1	.33	S/U FOR BENCH WORK GENERAL	PRO RATE 3 OPERATIONS	.27525		.112			
0020		E					RBW-BU-P1	1.00	BUTTERFLY POLISH BUSHING I D	POL/BUTTERFLY TRUN END<LEFT>	.00333		.004			
0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0260			UP	01		24		1.00		DEGREASE TRUNNION	.150	.036	.187		16	
0005		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT<		.14095		.174			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0270			UP	01		24		1.00		ANODIZE TYPE II	.373	.090	.463	.8	41	
0010		E					ZPL-AN-M1	1.00	ANODIZE MEDIUM SIZE PART <		.36341		.450			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
0395			UP	01		24		.05		ALODINE CENTER LUG HOLES	.450	.005	.028		2	
0005		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT<		.14095		.174			
0010		E					RPL-AL-L1	1.00	ALODINE LARGE PART - HOIST <		.29943		.371			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC<		.01001		.012			
9000			UP	01		24		.01		LABOR STANDARD HISTORY	.000	.000	.000		0	
0010									PRIOR HISTORY ON OO ALC 494 FORM							
0020									27JUN83 UPDATE OPERATION	<OLD STD> 1.66						
0021									27DEC84 2 YR REVIEW W/OCC CHANGE	> OLD STD < 1.66						
0022									7 OCT85 CHANGED SUBOPS TO MATCH 958	OLD STD .35						
0900									JENSEN	MANEL 73255						

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR

LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 02/01/88 A-E046B-MM1-BY-M45 PAGE 0001

74521A STRUT ASSY C-141 MLG RCC MNPRC 4S2-59-3 81174

SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC505		S	N	UP	EA B		J 85268	.38	PERCENT ENGR 69.8	PLATE TRUNNION PIN OCC X 2	1.77		.67			
0001				UP	00	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010									3G61014-101	1620000271196						
0032				UP	01	24		1.00		DEGREASE	.115	.028	.143		8	
0010		E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0034				UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	9	
0010		E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0036				UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	0	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040				UP	01	24		.57		STRIP CHROME LARGE DIA.	.186	.026	.132	24.0	7	
0010		E					ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART/		.17652		.218			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012			
0050				UP	01	24		.07		STRIP CHROME SMALL DEA.	.098	.002	.009	24.0	0	
0010		E					ZCR-ST-S2	.50	STRIP CHROME O.D. SMALL PARTOCC FOR 2 EA AREAS AT A TIME		.17652		.109			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC\		.01001		.012			
0100				UP	01	24		.50		BAKE AFTER ETCH	.171	.021	.106	8.0	6	
0010		E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	,	.16175		.200			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012			
115				UP	01	24		.05		DEGREASE	.115	.001	.007		0	
0010		E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0120				UP	01	24		.57		SHOTPEEN LARGE DIAMETER	.090	.012	.064		4	
0010		E					RPL-SP-M1	.50	SHOT PEEN SMALL/MED PART	OCC FOR 2 EA AREAS	.16131		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC\		.01001		.012			
0122				UP	01	24		.07		SHOTPEEN SMALL DIAMETER	.090	.002	.008		0	
0010		E					RPL-SP-M1	.50	SHOT PEEN SMALL/MED PART	OCC FOR 2 EA AREAS	.16131		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC\		.01001		.012			
0125				UP	01	24		.57		PREP FOR CHROME	.360	.049	.254		14	
0010		N						1.00		PREP FOR CHROME	.35000		.434			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0130				UP	01	24		.57		CHROME PLATE LARGE DIAMETER	.300	.041	.212	24.0	12	
0010		N						1.00		CHROME PLATE	.29000		.359			
0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC\		.01001		.012			
0135				UP	01	24		.07		PREP FOR CHROME	.360	.006	.031		2	
0010		N						1.00		PREP FOR CHROME	.35000		.434			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0140				UP	01	24		.07		CHROME PLATE SMALL DIAMETER	.300	.005	.026	24.0	1	
0010		N						1.00		CHROME PLATE	.29000		.359			
0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC\		.01001		.012			
0150				UP	01	24		.43		BAKE AFTER CHROME PLATE	.090	.009	.048	8.0	3	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	/	.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC'		.01001		.012			
0180				UP	01	24		.57		BAKE AFTER GRIND	.090	.012	.064	8.0	4	
0010		E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE	/	.08088		.100			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC'		.01001		.012			
0195				UP	01	24		.05		DEGREASE	.115	.001	.007		0	
0010		E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0205				UP	01	24		.96		GRIT BLAST PRIOR TO CAD	.086	.020	.103		6	
0010		E					RPL-SB-M2	.75	SANDBLAST MED PART WALK-IN BPRORATED SMALL PART		.10180		.094			

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    0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001          .012
 0210       UP 01    24         .95                           CAD PLT                      .102    .023    .120          7
    0010 E         ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                                  .09212          .114
    0060 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                             .01001          .012
 0220       UP 01    24        1.00                           BAKE AFTER CAD PLATE         .090    .022    .113 38.0     6
    0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE  /                             .08088          .100
    0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC'                             .01001          .012
 0221       UP 01    24         .95                           IRIDITE                      .106    .024    .125          7
    0010 E         ZPL-IR-M1  1.00 IRIDITE MEDIUM PART-HOIST   ,                             .09635          .119
    0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                             .01001          .012
 0224       UP 01    24         .05                           I.V.D. ALUMINUM PLATE        .230    .003    .014  1.0     1
    0010 N                    1.00                            I.V.D. PLATE                 .22000          .272
    0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                             .01001          .012
 0225       UP 01    24         .05                           ALODINE I.V.D. ALUM PLATE    .230    .003    .014          1
    0010 N                    1.00                            ALODINE                      .22000          .272
    0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                             .01001          .012
 9000       UP 01    24         .00                           LABOR STANDARD HISTORY       .000    .000    .000          0
    0010                             PRIOR HISTORY ON OO-ALC 494 FORM
    0020                            27JUN83 NEW OCC FACTOR STUDY   <OLD STD>        .63
    0021                            27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <    .88
    0022                            25SEPT85 CHANGED SUBOPS TO MATCH 958 OLD STD  .93
    0023                            17 APRIL 87 ADDED SUBOPS 0221, 0224, 0225
    0024                            <OLD STD 1.31>
    0900                                  KERRY COOP MANEL TECHN 73357


TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 02/01/88 A-E046B-MM1-DY-M45 PAGE 0001

74521A STRUT ASSY C-141 NLG RCC MMPRC 4S2-59-3 81174

SUB / STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC510	S	E	UP	EA	B		J 87341	1.00	PERCENT ENGR 99.9	PLT BEARING	.34		.34			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000			0
0020									3G61226-101	1620001257860						
0030									115689A	NSN						
0040			UP	01		24		1.00		STRIP OLD ANODIZE	.206	.050	.256	.5	75	
0005		E					RPL-DE-L1	.50	DEGREASE LARGE PART OR BASKTOCC FOR SMALL PART		.14095		.087			
0010		E					ZCD-ST-S1	1.00		STRIP ANODIZE	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01		25		1.00		ANODIZE BEARING	.068	.017	.086	.7	25	
0010		E					ZPL-AN-S1	1.00	ANODIZE SMALL PART		.05892		.073			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
9000			UP	01		00		1.00		LABOR STANDARD HISTORY	.000	.000	.000			0
0010									07DEC87 INITIAL INPUT BUILT TO MATCH 958							
0020									J							
0900									JENSEN	MANEL 73255						

TO INTERROGATE LABOR STANDARDS, INPUT

PR[illegible] NR
<----X<--->
12[illegible]67890123456 ELSE PUT IN END
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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 02/01/88 A-E046B-MM1-DY-M45 PAGE 0001

74521A STRUT ASSY C-141 MLG RCC MNPRC 4S2-59-3 81174

TECH SUB STEP	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY PCT	A C
RC511	S	N	UP	EA	B	J 84194	.90	PERCENT ENGR 74.7	PLATE STEERING COLLAR 407	2.04		1.84		
0001			UP	00	00		.00		PART NUMBER/NSN	.000	.000	.000		0
0010								3G61092-111	1620009294672					
0032			UP	01	24		1.00		DEGREASE	.115	.028	.143		7
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0035			UP	01	24		.95		STRIP CAD	.136	.031	.161	.5	8
0010	E					ZCD-ST-S1	1.00	STRIP CAD PLATE SMALL PART		.12630		.156		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0040			UP	01	24		.05		STRIP RUST	.136	.002	.008	.3	0
0010	E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0055			UP	01	24		.05		STRIP CHROME I.D.	.252	.003	.016	24.0	1
0010	E					ZCR-ST-S1	1.00	STRIP CHROME I.D.SMALL PART ,		.24234		.300		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0060			UP	01	24		.10		STRIP CHROME FACES	.186	.004	.023	24.0	1
0010	E					ZCR-ST-S2	1.00	STRIP CHROME O.D. SMALL PART,		.17652		.218		
0900	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0100			UP	01	24		.30		BAKE AFTER ETCH	.090	.007	.034	8.0	2
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,		.08088		.100		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0115			UP	01	24		.05		DEGREASE	.115	.001	.007		0
0010	E					RPL-DE-L1	.75	DEGREASE LARGE PART OR BASKT	PRORATED FOR SMALL PART	.14095		.131		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0120			UP	01	24		.05		SHOTPEEN I.D.	.171	.002	.011		1
0010	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART ,		.16131		.200		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0125			UP	01	24		.15		SHOT PEEN 2 EA FACES	.171	.006	.032		2
0010	E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART ,		.16131		.200		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0128			UP	01	24		.10		PREP FOR CHROME	.480	.012	.060		3
0010	N						1.00		PREP FOR CHROME	.47000		.582		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0130			UP	01	24		.10		CHROME PLATE I.D.	.330	.008	.041	30.0	2
0030	N						1.00		CHROME PLATE	.32000		.396		
0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0150			UP	01	24		.10		BAKE AFTER CHROME	.090	.002	.011	8.0	1
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,		.08088		.100		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0153			UP	01	24		.25		PREP FOR CHROME	.480	.029	.149		7
0010	N						1.00		PREP FOR CHROME	.47000		.582		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0155			UP	01	24		.25		CHROME PLATE COLLAR #1	.330	.020	.102	24.0	5
0030	N						1.00		CHROME PLATE	.32000		.396		
0040	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0157			UP	01	24		.25		BAKE AFTER CHROME	.090	.005	.028	8.0	1
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,		.08088		.100		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0180			UP	01	24		.20		BAKE AFTER GRIND	.090	.004	.023	8.0	1
0010	E					ZPL-BK-S1	1.00	BAKE SM PART 4HR/24HR BAKE ,		.08088		.100		
0020	E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC,		.01001		.012		
0200			UP	01	24		.15		PREP FOR CHROME	.480	.017	.089		4
0010	N						1.00		PREP FOR CHROME	.47000		.582		

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     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001            .012
0210        UP 01   24          .15                     CHROME FACE #2                           .330    .012      .061 24.0   3
     0030 N                    1.00                     CHROME PLATE                             .32000            .396
     0040 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0220        UP 01   24          .15                     BAKE AFTER CHROME                        .090    .003      .017  8.0   1
     0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE  ,                                 .08088            .100
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0250        UP 01   24          .25                     BAKE AFTER GRIND FACE                    .090    .005      .028  8.0   1
     0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE  ,                                 .08088            .100
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0265        UP 01   24          .05                     DEGREASE                                 .115    .001      .007        0
     0010 E         RPL-DE-L1   .75 DEGREASE LARGE PART OR BASKT  PRORATED FOR SMALL PART         .14095            .131
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001            .012
0275        UP 01   24          .96                     GRIT BLAST PRIOR TO CAD                  .086    .020      .103        5
     0010 E         RPL-SB-M2   .75 SANDBLAST MED PART WALK-IN BPRORATED SMALL PART               .10180            .094
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001            .012
0280        UP 01   24         1.00                     CAD PLATE                                .102    .025      .127        6
     0030 E         ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART    ,                                 .09212            .114
     0040 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0290        UP 01   24         1.00                     BAKE AFTER CAD                           .090    .022      .113 38.0   5
     0010 E         ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE  ,                                 .08088            .100
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0304        UP 01   24          .05                     DEGREASE                                 .115    .001      .007        0
     0010 E         RPL-DE-L1   .75 DEGREASE LARGE PART OR BASKT  PRORATED FOR SMALL PART         .14095            .131
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                  .01001            .012
0307        UP 01   24          .05                     I.V.D. ALUMINUM PLATE                    .230    .003      .014  1.0   1
     0010 N                    1.00                     I.V.D. PLATE                             .22000            .272
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                 .01001            .012
0310        UP 01   24         1.00                     DRY FILM LUBE                            .222    .053      .276       13
     0010 E         RPL-DF-S1  1.00 DRYFILM LUBE 1ST SM/MED PART,                                 .21250            .263
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0315        UP 01   24         1.00                     BAKE AFTER DRY LUB                       .171    .041      .213  2.0  10
     0010 E         ZPL-BK-M1  1.00 BAKE MED/LRG SIZE PART      ,.                                .16175            .200
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0318        UP 01   24         1.00                     IRIDITE                                  .106    .026      .132        6
     0010 E         ZPL-IR-M1  1.00 IRIDITE MEDIUM PART-HOIST   ,                                 .09635            .119
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                                 .01001            .012
0319        UP 01   24          .05                     ALODINE I.V.D. ALUM PLATE                .230    .003      .014        1
     0010 N                    1.00                     ALODINE                                  .22000            .272
     0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                                 .01001            .012
9000        UP 01   24          .01                     LABOR STANDARD HISTORY                   .000    .000      .000        0
     0010                           PRIOR HISTORY ON 00-ALC 494 FORM
     0020                          27JUN83 NEW OCC FACTOR STUDY  &lt;OLD STD&gt;        2.77
     0021                          27DEC84 2 YR REVIEW W/OCC CHANGE &gt; OLD STD &lt;  2.71
     0022                          4 OCT85 CHANGED SUBOPS TO MATCH 958  OLD STD  2.33
     0900                          JENSEN               MANEL                 73255


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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                         LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   02/01/88    A-E046B-MM1-DY-M45  PAGE  0001
      74521A    STRUT ASSY C-141 MLG                           RCC MNPRC               4S2-59-3                 81174
      TECH S S    W F PF A/R REV
 SUB       T K   #R A FA SUPPORT   OCC <-------------------- DESCRIPTION ------------------> BASE    PFD    STD             A
      STEP D L    K C DC ELEMENT   FACT            STORED                SUPPLEMENTAL        HOURS   TIME   HOURS     DLY PCT C
---------------------------------------------------------------------------------------------------------------------------------
RC512    S  N UP EA B    J 84194   .89 PERCENT ENGR 64.4          PLATE STEERING PLATE      407   1.43          1.27
   0001       UP 01    00          .00                            PART NUMBER/NSN                 .000   .000   .000         0
      0010                             3G61027-101          1620000110320
   0030       UP 01    24          1.00                           DEGREASE                        .115   .028   .143        10
      0010 E           RPL-DE-L1   .75 DEGREASE LARGE PART OR BASKT  PRORATED FOR SMALL PART      .14095        .131
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001        .012
   0035       UP 01    24          .88                            STRIP NICKEL PLATE              .252   .053   .275 40.0  19
      0010 E           ZCR-ST-S1  1.00 STRIP CHROME I.D.SMALL PART ,                              .24234        .300
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                              .01001        .012
   0085       UP 01    24         1.00                            DEGREASE                        .115   .028   .143        10
      0010 E           RPL-DE-L1   .75 DEGREASE LARGE PART OR BASKT  PRORATED FOR SMALL PART      .14095        .131
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001        .012
   0095       UP 01    24          .71                            SHOTPEEN I.D.                   .171   .029   .151        11
      0020 E           RPL-SP-M1  1.00 SHOT PEEN SMALL/MED PART     ,                             .16131        .200
      0030 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                              .01001        .012
   0150       UP 01    24         1.00                            PREP FOR NICKEL                 .210   .050   .260        18
      0010 N                      1.00                            PREP FOR NICKLE                 .20000        .248
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001        .012
   0160       UP 01    24         1.00                            SUFIMATE NICKEL PLATE           .220   .053   .273 24.0  19
      0010 N                      1.00                            NICKLE PLATE SMALL PART         .21020        .260
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                              .01001        .012
    165       UP 01    24          .88                            BAKE AFTER PLATE                .090   .019   .099 38.0   7
      0010 E           ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE   ,                             .08088        .100
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                              .01001        .012
   0168       UP 01    24          .76                            BAKE AFTER GRIND                .090   .017   .086  8.0   6
      0010 E           ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE   ,                             .08088        .100
      0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC,                              .01001        .012
   9000       UP 01    24          .01                            LABOR STANDARD HISTORY          .000   .000   .000         0
      0010                              PRIOR HISTORY ON OO-ALC 494 FORM
      0020                             27JUN83 NEW OCC FACTOR STUDY  <OLD STD>        .32
      0030                             14OCT83 UPGRADE TO 'E' STD      <OLD STD>      .08
      0031                             27DEC84 2 YR REVIEW W/OCC CHANGE > OLD STD <   .09
      0032                             4 OCT85 CHANGED TO MATCH 958 STEPS OLD STD     .78
      0900                             JENSEN                 MANEL                 73255


TO INTERROGATE LABOR STANDARDS, INPUT

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                      LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   12/19/88    A-E046B-MM1-DY-M45  PAGE  0001
      74521A    STRUT ASSY C-141 NLG                              RCC MNPRC               4S2-59-3               81174
       TECH S S    W F PF A/R REV
  B         T K   #R A FA SUPPORT   OCC <-------------------- DESCRIPTION -------------------> BASE    PFD     STD          A
                                                                                            
       STEP D L    K C DC ELEMENT  FACT              STORED                   SUPPLEMENTAL     HOURS   TIME    HOURS    DLY PCT C
-------------------------------------------------------------------------------------------------------------------------------
KNPRC    S  E UP EA B     J 88349  1.00 PERCENT ENGR 99.9          C-141 NOSE MISC CAT. S-1       1.24            1.24
  0001       UP 01    00            .00                             PART NUMBER/NSN STEEL S-1      .000    .000     .000         0
     0010                               3G61227-101          5305000587840
     0020                               3G61042-101          5305007069361
     0030                               7127998-01           5365000073413
  0010       UP 01    24            .13                             DEGREASE                       .291    .009     .047         4
     0010 E            RWB-CV-D1   3.00 VAPOR CL (DEGR)HOOK/BASKET                                 .08709           .323
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
  0011       UP 01    24            .13                             STRIP CAD                     2.556    .080     .412     .5  33
     0010 E            ZCD-ST-S1  20.00 STRIP CAD PLATE SMALL PART                                 .12630          3.132
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
  0012       UP 01    24            .13                             STRIP RUST                     .535    .017     .086     .3   7
     0010 E            ZCD-ST-S1   4.00                             STRIP RUST                     .12630           .626
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
  0013       UP 01    24            .13                             GRIT BLAST                     .140    .004     .023         2
     0010 E            RWB-CB-B1   3.00 BLAST SM PT OR BSKT V/SM PTS                               .03668           .136
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
  0014       UP 01    24            .13                             CAD PLATE                     1.872    .058     .302        24
     0010 E            ZPL-CD-S1  20.00 CADMIUM PLATE SMALL PART                                   .09212          2.284
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
  0015       UP 01    24            .13                             BAKE AFTER CAD PLATE           .272    .009     .044 38.0    4
     0010 E            ZPL-BK-S1   3.00 BAKE SM PART 4HR/24HR BAKE                                 .08088           .300
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
    16       UP 01    24            .13                             CHROMATE CONVERSION(IRIDITE)   .502    .016     .081         7
     0010 E            ZPL-IR-S1  20.00 IRIDITE SMALL PART                                         .02362           .585
     0020 E            RJP-PW-R1   3.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .037
  0120       UP 01    00            .00                             PART NUMBER /NSN STEEL S-7     .000    .000     .000         0
     0010                               3G61160-101           5310000511078
     0020                               3G61088-101          5310000224942
  0129       UP 01    00            .13                             BRUSH PLATE O.D.              1.547    .000     .201        16
     0010 E            RLG-RS-B1  16.00 BRUSH PLATE SPOT OR HOLE                                   .09546          1.527
     0020 E            RJP-PW-R1   2.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .020
  0400       UP 01    00            .00                             PART NUMBER/NSN ALUM. A-1      .000    .000     .000         0
     0010                               3G61030-103          5310009740834
  0409       UP 01    24            .13                             STRIP ANODIZE MED PART         .136    .004     .022     .5   2
     0010 E            ZCD-ST-S1   1.00                             STRIP ANODIZE                  .12630           .156
     0020 E            RJP-PW-R1   1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .012
  0412       UP 01    24            .13                             ANODIZE SMALL PART             .156    .005     .025     .8   2
     0010 E            RWB-CV-D1   1.00 VAPOR CL (DEGR)HOOK/BASKET                                 .08709           .107
     0020 E            ZPL-AN-S1   1.00 ANODIZE SMALL PART                                         .05892           .073
     0030 E            RJP-PW-R1   1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001           .012
  9000       UP 01    00            .00                             LABOR STANDARD HISTORY         .000    .000     .000         0
     0010                               NOV 21 1988 INITIAL INPUT
     0900                               BOB ROSS MANEL 73255


INTERROGATE LABOR STANDARDS, INPUT
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                 LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   07/20/88    A-E046B-MM1-DY-M45  PAGE  0001
       69657A     STRUT KC135 MLG L/H                        RCC MNPRC                  4S1-56-3  038-9102      83086
ER   TECH S S    W F PF A/R REV
 SUB      T K   #R A FA SUPPORT   OCC <------------------- DESCRIPTION ------------------->  BASE    PFD    STD          A
    STEP  D L    K C DC ELEMENT   FACT           STORED                   SUPPLEMENTAL        HOURS   TIME   HOURS   DLY PCT C
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RC015    S  E UP EA B    J 88167   .35 PERCENT ENGR 94.9          BEARING LOWER              .53            .18
  0001        UP 00   00           .00                             PART NO/NSN               .000   .000    .000          0
    0010                               7653528-01           3120010403938
  0033        UP 01   24          1.00                             DEGREASE                  .097   .023    .120         22
    0010 E             RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                            .08709         .107
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001         .012
  0037        UP 01   24          1.00                             STRIP CAD                 .136   .033    .169   .5    32
    0010 E             ZCD-ST-S1  1.00 STRIP CAD PLATE SMALL PART                            .12630         .156
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001         .012
  0038        UP 01   24          1.00                             GRIT BLAST                .046   .011    .058         11
    0010 E             RWB-CB-B1  1.00 BLAST SM PT OR BSKT W/SM PTS                          .03668         .045
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001         .012
  0040        UP 01   24           .95                             CAD PLATE                 .102   .023    .120         22
    0010 E             ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                              .09212         .114
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001         .012
  0042        UP 01   24           .95                             CHROMATE CONVERSION(IRIDITE) .033 .008   .040          7
    0010 E             ZPL-IR-S1  1.00 IRIDITE SMALL PART                                    .02362         .029
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                          .01001         .012
  0044        UP 01   24           .05                             I.V.D. ALUMINUM PLATE     .230   .003    .014  1.0     3
    0010 N                        1.00                             I.V.D. PLATE              .22000         .272
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                         .01001         .012
  0046        UP 01   24           .05                             ALODINE I.V.D. ALUM PLATE .230   .003    .014          3
    0010 N                        1.00                             ALODINE                   .22000         .272
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                         .01001         .012
  9000        UP 01   24           .01                             LABOR STD HISTORY         .000   .000    .000          0
    0010                                        INITIAL INPUT MARCH 1983
    0020                               20APR85 DOWNGRADE TO N STD - WAS 0.12 HRS
    0990                                        K W SHIPLEY MANEAA 63357


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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                           LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   07/20/88    A-E046B-MM1-DY-M45  PAGE  0001
            69657A    STRUT KC135 MLG L/H                       RCC MNPRC              4S1-56-3  038-9102      83086
  R    TECH S S    W F PF A/R REV
  SUB       T K   #R A FA SUPPORT   OCC <------------------ DESCRIPTION ----------------->  BASE    PFD     STD
       STEP D L    K C DC ELEMENT   FACT           STORED                SUPPLEMENTAL        HOURS   TIME    HOURS    DLY PCT (
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RC016    S  E UP EA B    J 88173   .35 PERCENT ENGR 99.9          PIN,METERING                .36              .12
   0001      UP 00   00            .00                            PART NO/NSN                 .000    .000     .000         0
       0010                            65-5735            1620007390166
   0030      UP 01   24            1.00                           STRIP ANODIZE SMALL PART    .136    .033     .169   .5  47
       0010 E             ZCD-ST-S1  1.00                         STRIP ANODIZE               .12630           .156
       0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001           .012
   0040      UP 01   24            1.00                           ANODIZE SMALL PART          .156    .037     .193   .8  53
       0010 E             RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                          .08709           .107
       0020 E             ZPL-AN-S1  1.00 ANODIZE SMALL PART                                  .05892           .073
       0030 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001           .012
   9000      UP 01   24            .01                            LABOR STANDARD HISTORY      .000    .000     .000         0
       0010                                 INITIAL INPUT MARCH 1983
       0020                            20APR85 DOWNGRADE TO N STD - WAS 0.08 HRS
       0990                                 K W SHIPLEY MANEAA 63357


TO INTERROGATE LABOR STANDARDS, INPUT

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69657A STRUT KC135 MLG L/H RCC MNPRC 4S1-56-3 038-9102 83086

OPER STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
XNPRC	S	X	UP	EA	B	J	88189	1.00	PERCENT ENGR 89.8	PLATE MISC. PARTS KC-135 MLG	2.09		2.09			
0001			UP	01		00		.00		PART NUMBER/NSN STEEL S-1	.000	.000	.000		0	
0010									69-11808	5365007912952						
0020									69-11810	5365007912953						
0010			UP	01		24		.13		DEGREASE	.097	.003	.016		1	
0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0011			UP	01		24		.13		STRIP CAD	1.020	.032	.164	.5	8	
0010		E					ZCD-ST-S1	8.00	STRIP CAD PLATE SMALL PART		.12630		1.252			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0012			UP	01		24		.13		STRIP RUST	.136	.004	.022	.3	1	
0010		E					ZCD-ST-S1	1.00		STRIP RUST	.12630		.156			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0013			UP	01		24		.13		GRIT BLAST	.046	.001	.008		0	
0010		E					RWB-CB-R1	1.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.045			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0014			UP	01		24		.13		CAD PLATE	.746	.023	.120		6	
0010		E					ZPL-CD-S1	8.00	CADMIUM PLATE SMALL PART		.09212		.913			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0015			UP	01		24		.13		BAKE AFTER CAD PLATE	.657	.020	.106	38.0	5	
0010		E					ZPL-BK-S1	8.00	BAKE SM PART 4HR/24HR BAKE		.08088		.802			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0016			UP	01		24		.13		CHROMATE CONVERSION(IRIDITE)	.198	.006	.032		2	
0010		E					ZPL-IR-S1	8.00	IRIDITE SMALL PART		.02362		.234			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060			UP	01		00		.00		PART NUMBER/NSN STEEL S-4	.000	.000	.000		0	
0010									30-3112	5310005934352						
0020									60-6535-1	N.S.L.						
0030									7739141-01	N.S.L.						
0040									30-3115-1	1620011480433						
0050									30-3115-3	1620007958724						
0067			UP	01		24		.13		DEGREASE	.291	.009	.047		2	
0010		E					RWB-CV-D1	3.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.323			
0020		E					RJP-PW-R1	3.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.037			
0068			UP	01		24		.13		STRIP CAD	3.061	.096	.493	.5	24	
0010		E					ZCD-ST-S1	24.00	STRIP CAD PLATE SMALL PART		.12630		3.758			
0020		E					RJP-PW-R1	3.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.037			
0069			UP	01		24		.13		STRIP RUST	.408	.013	.066	.3	3	
0010		E					ZCD-ST-S1	3.00		STRIP RUST	.12630		.469			
0020		E					RJP-PW-R1	3.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.037			
0070			UP	01		24		.13		GRIT BLAST	.140	.004	.023		1	
0010		E					RWB-CB-B1	3.00	BLAST SM PT OR BSKT V/SM PTS		.03668		.136			
0020		E					RJP-PW-R1	3.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.037			
0071			UP	01		24		.13		I.V.D. ALUMINUM PLATE	.690	.022	.111	1.0	5	
0010		N						3.00		I.V.D. PLATE	.22000		.818			
0020		E					RJP-PW-R1	3.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.037			
0072			UP	01		24		.13		ALODINE I.V.D. ALUM PLATE	.690	.022	.111		5	
0010		N						3.00		ALODINE	.22000		.818			
0020		E					RJP-PW-R1	3.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.037			

0400	UP 01	00	.00		PART NUMBER/NSN ALUM. .. 1	.000	.000	.000		0
0010				69-1173-1	1620006020297					
0020				69-1173-2	1620006020298					
0030				90-8654	1620005725325					
[illegible]9	UP 01	24	.13		STRIP ANODIZE MED PART	2.040	.064	.329	.5	16
0010 E		ZCD-ST-S1	16.00		STRIP ANODIZE	.12630		2.505		
0020 E		RJP-PW-R1	2.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.024		
0412	UP 01	24	.13		ALODINE SMALL PART	1.612	.050	.260		12
0010 E		RPL-AL-S1	16.00	ALODINE 1ST SMALL ALUM PART		.09953		1.974		
0020 E		RJP-PW-R1	2.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.024		
0480	UP 01	00	.00		PART NUMBER/ NSN ALUM. A-5	.000	.000	.000		0
0010				65-5754-1	1620007651370					
0020				65-5754	N.S.L.					
0030				69-1176	N.S.L.					
0486	UP 01	24	.13		ANODIZE SMALL PART	1.136	.035	.183	.8	9
0010 E		RWB-CV-D1	2.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.215		
0020 E		ZPL-AN-S1	16.00	ANODIZE SMALL PART		.05892		1.168		
0030 E		RJP-PW-R1	2.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.024		

TO INTERROGATE LABOR STANDARDS, INPUT

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 RCC PRD NROP NR
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0230	UP 01	24		.01	NICKEL	.420	.001	.005	24.0	0
0010 N				1.00	NICKEL PLT LARGE PART	.41000		.508		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0235	UP 01	24		.01	NICKEL	.420	.001	.005	24.0	0
0010 N				1.00	NICKEL PLT LARGE PART	.41000		.508		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0245	UP 01	24		.50	BAKE AFTER NICKEL	.171	.021	.106	8.0	2
0010 E			ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0280	UP 01	24		.65	BAKE AFTER GRIND	.171	.027	.138	8.0	2
0010 E			ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0305	UP 01	24		.95	GRIT BLAST PRIOR TO CAD/IVD	.326	.075	.385		7
0010 E			RPL-SB-L2	1.00 SANDBLAST LARGE PART - HOIST		.31693		.392		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0310	UP 01	24		.95	CAD PLATE	.824	.188	.971		17
0010 E			ZPL-CD-L1	1.00 CADMIUM PLATE LRG PART-HOIST		.81410		1.009		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0330	UP 01	24		.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0	4
0010 E			ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0332	UP 01	24		.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138		2
0010 E			ZPL-IR-L1	1.00 IRIDITE LARGE PART-HOIST		.10705		.132		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0337	UP 01	24		.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0	1
0010 N				1.00	I.V.D. PLATE	.81400		1.009		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0338	UP 01	24		.05	ALODINE I.V.D. ALUM PLATE	.425	.005	.026		0
0010 N				1.00	ALODINE	.41500		.514		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
9000	UP 01	24		.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010				INITIAL INPUT MARCH 1983						
0020				20APR85 DOWNGRADE TO N STD - WAS 5.33 HRS						
0990				K W SHIPLEY MANEAA 63357						

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR
<---X-----X--->
1234567890123456 ELSE PUT IN END
?

69657A STRUT KC135 MLG L/H RCC MMPRC 4S1-56-3 038-9102 83086

TR SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC014	S	N	UP	EA	B		J 88167	1.00	PERCENT ENGR 65.9	INNER CYLINDER	5.55		5.55			
0001			UP	00		00		.00		PART NO/NSN	.000	.000	.000		0	
0010									65-1265-8	1620000842104						
0035			UP	01		24		1.00		DEGREASE	.150	.036	.187		3	
0010		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0040			UP	01		24		.95		STRIP CAD	.262	.060	.309	.5	6	
0010		E					ZCD-ST-M1	1.00	STRIP CAD ID/OD MED/LRG PART		.25260		.313			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0045			UP	01		24		.05		STRIP RUST	.262	.003	.016	.3	0	
0010		E					ZCD-ST-M1	1.00		STRIP RUST	.25260		.313			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0050			UP	01		24		.25		STRIP CHROME LARGE PART O.D.	.363	.022	.113	24.0	2	
0010		E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0060			UP	01		24		.25		STRIP CHROME LARGE PART I.D.	.494	.030	.153	24.0	3	
0010		E					ZCR-ST-M1	1.00	STRIP CHROME ID MED/LRG PART		.48467		.600			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0070			UP	01		24		.10		GRIT BLAST PRIOR TO CAD/IVD	.326	.008	.041		1	
0010		E					RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST		.31693		.392			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0180			UP	01		24		.75		BAKE AFTER ETCH	.171	.031	.160	8.0	3	
0010		E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0195			UP	01		24		.75		DEGREASE	.150	.027	.140		3	
0010		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0200			UP	01		24		.75		SHOTPEEN LARGE PART/MASK	.548	.099	.510		9	
0010		E					ZMA-CL-04	1.00	MASK V/LRG CYL TYPE PART		.32667		.405			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0205			UP	01		24		.50		PREP CHROME LARGE PART O.D.	.720	.086	.446		8	
0010		N						1.00		PREP FOR CHRMOE	.71000		.880			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0210			UP	01		24		.50		CHROME PLATE LARGE PART O.D.	.600	.072	.372	24.0	7	
0010		N						1.00		CHROME PLATE LARGE PART	.59000		.731			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0220			UP	01		24		.50		BAKE AFTER CHROME PLATE	.171	.021	.106	8.0	2	
0010		E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0223			UP	01		24		.49		PREP CHROME I.D. LARGE PART	.940	.111	.571		10	
0010		N						1.00		PREP CHROME I.D.	.93000		1.153			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0225			UP	01		24		.49		CHROME LARGE PART I.D.	.640	.075	.389	30.0	7	
0010		N						1.00		CHROME PLT LARGE PART	.63000		.781			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0226			UP	01		24		.01		PREP FOR NICKEL	.260	.001	.003		0	
0010		N						1.00		PREP FOR NICKEL LARGE PART	.25000		.310			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0228			UP	01		24		.01		GRIT BLAST FOR NICKEL	.326	.001	.004		0	
0010		E					RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST		.31693		.392			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			

0010 E			ZPL-BK-M1	.34 BAKE MED/LRG SIZE ,. (T		.16175		.068		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0500	UP 01	24		.75	BAKE AFTER GRIND	.171	.031	.160	8.0	3
0010 E			ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0515	UP 01	24		.75	DEGREASE	.150	.027	.140		3
0010 E			RPL-DE-L1	1.00 DEGREASE LARGE PART OR BASKT		.14095		.174		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0525	UP 01	24		1.00	GRIT BLAST PRIOR TO CAD/IVD	.326	.078	.405		8
0010 E			RPL-SB-L2	1.00 SANDBLAST LARGE PART - HOIST		.31693		.392		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0530	UP 01	24		.95	CAD PLATE	.824	.188	.971		19
0010 E			ZPL-CD-L1	1.00 CADMIUM PLATE LRG PART-HOIST		.81410		1.009		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0550	UP 01	24		.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0	4
0010 E			ZPL-BK-M1	1.00 BAKE MED/LRG SIZE PART		.16175		.200		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0555	UP 01	24		.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138		3
0010 E			ZPL-IR-L1	1.00 IRIDITE LARGE PART-HOIST		.10705		.132		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0563	UP 01	24		.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0	1
0010 N				1.00	I.V.D. PLATE	.81400		1.009		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0567	UP 01	24		.05	ALODINE I.V.D. ALUM PLATE	.425	.005	.026		1
0010 N				1.00	ALODINE	.41500		.514		
0020 E			RJP-PW-R1	1.00 REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
9000	UP 01	24		.01	LABOR STANDARD HISTORY	.000	.000	.000		0
0010				INITIAL INPUT MARCH 1983						
0020				20APR85 DOWNGRADE TO N STD - WAS 6.10 HRS						
0990				K W SHIPLEY MANEAA 63357						

TO INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR
<—X——X—>
1234567890123456 ELSE PUT IN END

0010 E		ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART	.16175		.100		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0333	UP 01	24	.28	GRIT BLAST FOR CHROME	.168	.011	.058		1
0010 E		RPL-SB-L2	.50	SANDBLAST LARGE PART - HOIST	.31693		.196		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0335	UP 01	24	.28	PREP CHROME I.D. LARGE PART	.475	.032	.165		3
0010 N			.50	PREP CHROME I.D.	.93000		.576		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0340	UP 01	24	.28	CHROME LARGE PART I.D.	.325	.022	.113	30.0	2
0010 N			.50	CHROME PLT LARGE PART	.63000		.390		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0350	UP 01	24	.28	BAKE AFTER CHROME PLATE	.090	.006	.032	8.0	1
0010 E		ZPL-BK-M1	.50	BAKE MED/LRG SIZE PART	.16175		.100		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0353	UP 01	24	.10	PREP FOR NICKEL	.260	.006	.032		1
0010 N			1.00	PREP FOR NICKEL LARGE PART	.25000		.310		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0357	UP 01	24	.10	GRIT BLAST FOR NICKEL	.326	.008	.041		1
0010 E		RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0360	UP 01	24	.10	NICKEL	.420	.010	.052	24.0	1
0010 N			1.00	NICKEL PLT LARGE PART	.41000		.508		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0370	UP 01	24	.10	BAKE AFTER NICKEL	.171	.004	.021	8.0	0
0010 E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0373	UP 01	24	.10	PREP FOR NICKEL	.095	.002	.012		0
0010 N			.34	PREP FOR NICKEL LARGE PART	.25000		.105		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0377	UP 01	24	.10	GRIT BLAST FOR NICKEL	.117	.003	.015		0
0010 E		RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST	.31693		.133		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0380	UP 01	24	.10	NICKEL	.149	.004	.019	24.0	0
0010 N			.34	NICKEL PLT LARGE PART	.41000		.172		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0390	UP 01	24	.10	BAKE AFTER NICKEL	.065	.002	.008	8.0	0
0010 E		ZPL-BK-M1	.34	BAKE MED/LRG SIZE PART	.16175		.068		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0393	UP 01	24	.10	PREP FOR NICKEL	.095	.002	.012		0
0010 N			.34	PREP FOR NICKEL LARGE PART	.25000		.105		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0397	UP 01	24	.10	GRIT BLAST FOR NICKEL	.117	.003	.015		0
0010 E		RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST	.31693		.133		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0400	UP 01	24	.10	NICKEL	.149	.004	.019	24.0	0
0010 N			.34	NICKEL PLT LARGE PART	.41000		.172		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0410	UP 01	24	.10	BAKE AFTER NICKEL	.065	.002	.008	8.0	0
0010 E		ZPL-BK-M1	.34	BAKE MED/LRG SIZE PART	.16175		.068		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0413	UP 01	24	.10	PREP FOR NICKEL	.095	.002	.012		0
0010 N			.34	PREP FOR NICKEL LARGE PART	.25000		.105		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0417	UP 01	24	.10	GRIT BLAST FOR NICKEL	.117	.003	.015		0
0010 E		RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST	.31693		.133		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0420	UP 01	24	.10	NICKEL	.149	.004	.019	24.0	0
0010 N			.34	NICKEL PLT LARGE PART	.41000		.172		
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0430	UP 01	24	.10	BAKE AFTER NICKEL	.065	.002	.008	8.0	0

MNPRC69657ARC013

LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 08/17/88 A-E046B-MM1-DY-M45 PAGE 0001

69657A STRUT KC135 MLG L/H RCC MNPRC 4S1-56-3 038-9102 83086

JB STEP	TECH S S T K D L	W R #R K	F A A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	A PCT C
RC013	S E	UP	EA	B	J 88174	1.00	PERCENT ENGR 81.9	OUTER CYLINDER	5.18		5.18		
0001		UP	01	00		.00		PART NUMBER/NSN	.000	.000	.000		0
0010							65-5763-17	1620009274739					
0020							65-5763-18	1620009592078					
0030							50-9712-32	1620007871750					
0040							50-9712-31	1620007871749					
0010		UP	00	00		.00		PART NO/NSN	.000	.000	.000		0
0010							65-5763-17	1620009274739					
0036		UP	01	24		1.00		DEGREASE	.150	.036	.187		4
0010	E				RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0037		UP	01	24		.95		STRIP CAD	.262	.060	.309	.5	6
0010	E				ZCD-ST-M1	1.00	STRIP CAD ID/OD MED/LRG PART		.25260		.313		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0038		UP	01	24		.05		STRIP RUST	.262	.003	.016	.3	0
0010	E				ZCD-ST-M1	1.00		STRIP RUST	.25260		.313		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0080		UP	01	24		.30		STRIP CHROME LARGE PART I.D.	.252	.018	.094	24.0	2
0010	E				ZCR-ST-M1	.50	STRIP CHROME ID MED/LRG PART		.48467		.300		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0090		UP	01	24		.30		STRIP CHROME LARGE PART I.D.	.252	.018	.094	24.0	2
0010	E				ZCR-ST-M1	.50	STRIP CHROME ID MED/LRG PART		.48467		.300		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0100		UP	01	24		.80		GRIT BLAST CORROSION	.117	.023	.117		2
0010	E				RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST		.31693		.133		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0110		UP	01	24		.70		GRIT BLAST CORROSION	.117	.020	.102		2
0010	E				RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST		.31693		.133		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0120		UP	01	24		.60		GRIT BLAST CORROSION	.117	.017	.088		2
0010	E				RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST		.31693		.133		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0290		UP	01	24		.75		BAKE AFTER ETCH	.171	.031	.160	8.0	3
0010	E				ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0305		UP	01	24		.75		DEGREASE	.150	.027	.140		3
0010	E				RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0310		UP	01	24		.90		SHOTPEEN LARGE PART/MASK	.548	.119	.612		12
0010	E				ZMA-CL-04	1.00	MASK V/LRG CYL TYPE PART		.32667		.405		
0020	E				RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200		
0030	N				ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062		
0040	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0313		UP	01	24		.38		GRIT BLAST FOR CHROME	.168	.015	.079		2
0010	E				RPL-SB-L2	.50	SANDBLAST LARGE PART - HOIST		.31693		.196		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0315		UP	01	24		.38		PREP CHROME I.D. LARGE PART	.475	.043	.224		4
0010	N					.50		PREP CHROME I.D.	.93000		.576		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0320		UP	01	24		.38		CHROME LARGE PART I.D.	.325	.030	.153	30.0	3
0010	N					.50		CHROME PLT LARGE PART	.63000		.390		
0020	E				RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0330		UP	01	24		.38		BAKE AFTER CHROME PLATE	.090	.008	.043	8.0	1

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                      LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   07/06/98    A-E046B-4M1-DY-445  PAGE  0001
        69354A    STRUT ASSY KC135 NLG                  RCC MNPRC                         452-30-3  038-1912     92259
ER   TECH S S    W F PF A/R REV
 SUB      T K  #R A FA SUPPORT   OCC <-------------------- DESCRIPTION -------------------->  BASE    PFD    STD            A
     STEP D L    K C DC ELEMENT  FACT             STORED                  SUPPLEMENTAL          HOURS   TIME   HOURS   DLY PCT C
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RC501   S  N UP EA B    J 86134  .58 PERCENT ENGR 74.8             PLATE PISTON                4.26            2.47
  0001        UP 01   00         .58                               PART NUMBER/NSN             .000   .000     .000          0
     0010                             7531263-10            1620010184057
  0035        UP 01   24        1.00                               DEGREASE                    .150   .036     .187          4
     0010 E            RPL-DE-L1  1.00 DEGREASE LARGE PART OR BASKT                            .14095          .174
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0040        UP 01   24         .95                               STRIP CAD                   .262   .060     .309    .5    7
     0010 E            ZCD-ST-M1  1.00 STRIP CAD ID/OD MED/LRG PART                            .25260          .313
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0045        UP 01   24         .05                               STRIP RUST                  .262   .003     .016    .3    0
     0010 E            ZCD-ST-M1  1.00                             STRIP RUST                  .25260          .313
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0070        UP 01   24         .05                               STRIP CHROME LARGE PART O.D.  .070  .001    .004  24.0    0
     0010 E            ZCR-ST-M2   .17 STRIP CHROME OD MED/LRG PARTOCC 6 EA OPERATIONS         .35303          .074
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0080        UP 01   24         .05                               STRIP CHROME LARGE PART O.D.  .070  .001    .004  24.0    0
     0010 E            ZCR-ST-M2   .17 STRIP CHROME OD MED/LRG PARTOCC 6 EA OPERATIONS         .35303          .074
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0090        UP 01   24         .05                               STRIP CHROME LARGE PART O.D.  .070  .001    .004  24.0    0
     0010 E            ZCR-ST-M2   .17 STRIP CHROME OD MED/LRG PARTOCC 6 EA OPERATIONS         .35303          .074
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0100        UP 01   24         .05                               STRIP CHROME LARGE PART O.D.  .070  .001    .004  24.0    0
     0010 E            ZCR-ST-M2   .17 STRIP CHROME OD MED/LRG PARTOCC 6 EA OPERATIONS         .35303          .074
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0110        UP 01   24         .05                               STRIP CHROME LARGE PART O.D.  .070  .001    .004  24.0    0
     0010 E            ZCR-ST-M2   .17 STRIP CHROME OD MED/LRG PARTOCC 6 EA OPERATIONS         .35303          .074
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0120        UP 01   24         .05                               STRIP CHROME LARGE PART O.D.  .070  .001    .004  24.0    0
     0010 E            ZCR-ST-M2   .17 STRIP CHROME OD MED/LRG PARTOCC 6 EA OPERATIONS         .35303          .074
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0200        UP 01   24         .50                               BAKE AFTER ETCH             .171   .021     .106   8.0    2
     0010 E            ZPL-BK-M1  1.00 BAKE MED/LRG SIZE PART                                  .16175          .200
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0225        UP 01   24         .50                               DEGREASE                    .150   .012     .094          2
     0010 E            RPL-DE-L1  1.00 DEGREASE LARGE PART OR BASKT                            .14095          .174
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0230        UP 01   24         .05                               SHOTPEEN LARGE PART/MASK    .144   .002     .009          0
     0010 E            ZMA-CL-04   .25 MASK V/LRG CYL TYPE PART    OCC 4 EA OPERATIONS         .32667          .101
     0020 E            RPL-SP-M1   .25 SHOT PEEN SMALL/MED PART    OCC 4 EA OPERATIONS         .16131          .050
     0030 N            ZUM-CL-02   .25 UNMASK MEDIUM SIZE CYL PART OCC 4 EA OPERATIONS         .05067          .015
     0040 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0240        UP 01   24         .05                               SHOTPEEN LARGE PART/MASK    .144   .002     .009          0
     0010 E            ZMA-CL-04   .25 MASK V/LRG CYL TYPE PART    OCC 4 EA OPERATIONS         .32667          .101
     0020 E            RPL-SP-M1   .25 SHOT PEEN SMALL/MED PART    OCC 4 EA OPERATIONS         .16131          .050
     0030 N            ZUM-CL-02   .25 UNMASK MEDIUM SIZE CYL PART OCC 4 EA OPERATIONS         .05067          .015
     0040 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0250        UP 01   24         .43                               SHOTPEEN LARGE PART/MASK    .144   .015     .077          2
     0010 E            ZMA-CL-04   .25 MASK V/LRG CYL TYPE PART    OCC 4 EA OPERATIONS         .32667          .101
     0020 E            RPL-SP-M1   .25 SHOT PEEN SMALL/MED PART    OCC 4 EA OPERATIONS         .16131          .050
     0030 N            ZUM-CL-02   .25 UNMASK MEDIUM SIZE CYL PART OCC 4 EA OPERATIONS         .05067          .015
     0040 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001          .012
  0260        UP 01   24         .05                               SHOTPEEN LARGE PART/MASK    .548   .007     .034          1
     0010 E            ZMA-CL-04  1.00 MASK V/LRG CYL TYPE PART                                .32667          .405
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0020	E			RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART	.16131		.200		
0030	N			ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART	.05067		.062		
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0265		UP 01	24		.05	PREP CHROME LARGE PART O.D.	.720	.009	.045		1
0010	N				1.00	PREP FOR CHRMOE	.71000		.880		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0267		UP 01	24		.05	PREP CHROME LARGE PART O.D.	.720	.009	.045		1
0010	N				1.00	PREP FOR CHRMOE	.71000		.880		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0270		UP 01	24		.05	CHROME PLATE LARGE PART O.D.	.600	.007	.037	24.0	1
0010	N				1.00	CHROME PLATE LARGE PART	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0275		UP 01	24		.05	CHROME PLATE LARGE PART O.D.	.600	.007	.037	24.0	1
0010	N				1.00	CHROME PLATE LARGE PART	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0280		UP 01	24		.05	BAKE AFTER CHROME PLATE	.171	.002	.011	8.0	0
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0285		UP 01	24		.29	PREP CHROME LARGE PART O.D.	.720	.050	.259		6
0010	N				1.00	PREP FOR CHRMOE	.71000		.880		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0290		UP 01	24		.21	CHROME PLATE LARGE PART O.D.	.600	.030	.156	24.0	4
0010	N				1.00	CHROME PLATE LARGE PART	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0300		UP 01	24		.14	CHROME PLATE LARGE PART O.D.	.600	.020	.104	24.0	2
0010	N				1.00	CHROME PLATE LARGE PART	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0320		UP 01	24		.14	CHROME PLATE LARGE PART O.D.	.600	.020	.104	24.0	2
0010	N				1.00	CHROME PLATE LARGE PART	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0342		UP 01	24		.29	CHROME PLATE LARGE PART O.D.	.600	.042	.216	24.0	5
0010	N				1.00	CHROME PLATE LARGE PART	.59000		.731		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0345		UP 01	24		.29	BAKE AFTER CHROME PLATE	.171	.012	.062	8.0	1
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0430		UP 01	24		.14	BAKE AFTER GRIND	.171	.006	.030	8.0	1
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0440		UP 01	24		.50	DEGREASE	.150	.018	.094		2
0010	E			RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT	.14095		.174		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0454		UP 01	24		1.00	GRIT BLAST PRIOR TO CAD/IVD	.326	.078	.405		10
0010	E			RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0455		UP 01	24		1.00	GRIT BLAST PRIOR TO CAD/IVD	.326	.078	.405		10
0010	E			RPL-SB-L2	1.00	SANDBLAST LARGE PART - HOIST	.31693		.392		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0460		UP 01	24		.95	CAD PLATE	.824	.188	.971		23
0010	E			ZPL-CD-L1	1.00	CADMIUM PLATE LRG PART-HOIST	.81410		1.009		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0470		UP 01	24		.95	BAKE AFTER CAD PLATE	.171	.039	.202	38.0	5
0010	E			ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART	.16175		.200		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0480		UP 01	24		.95	CHROMATE CONVERSION(IRIDITE)	.117	.027	.138		3
0010	E			ZPL-IR-L1	1.00	IRIDITE LARGE PART-HOIST	.10705		.132		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC	.01001		.012		
0486		UP 01	24		.05	I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0	1
0010	N				1.00	I.V.D. PLATE	.81400		1.009		
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/	.01001		.012		

0487 UP 01	24		.05		ALODINE I.V.D. ALUM PLATE	.425	.005	.026	1
0010 N			1.00		ALODINE	.41500		.514	
0020 E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012	
9000 UP 01	00		.01		LABOR STANDARD HISTORY	.000	.000	.000	0
0001				16 MAY 88					
0010				KIM VINCENT, MANEL, 73952					

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                  LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   06/14/88    A-E046B-MM1-DY-M45  PAGE  0001
      69354A     STRUT ASSY KC135 NLG                        RCC MNPRC                 4S2-30-3  038-1912      82259
OPER   TECH S S    W F PF A/R REV
  SUB       T K   #R A FA SUPPORT   OCC <-------------------- DESCRIPTION --------------------> BASE    PFD     STD            A
     STEP D L     K C DC ELEMENT  FACT            STORED                  SUPPLEMENTAL          HOURS   TIME    HOURS    DLY PCT C
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RC503    S  E UP EA B     J 88154   .38 PERCENT ENGR 89.6          SHOT PEEN NUT KC-135 NLG        .60             .23
  0001        UP 01-   00           .00                            PART NUMBER/NSN                 .000    .000    .000          0
     0010                               60-6681               N.S.L.
     0020                               60-6681-1            5310010206440
     0030                               60-6681-2            5310010206440
  0045        UP 01    24          1.00                            DEGREASE                        .097    .023    .120         20
     0010 E            RWB-CV-D1   1.00 VAPOR CL (DEGR)HOOK/BASKET                                 .08709          .107
     0020 E            RJP-PW-R1   1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001          .012
  0050        UP 01    24          1.00                            SHOTPEEN MED PART/MASK          .391    .094    .486         80
     0010 E            ZMA-CL-02   1.00 MASK MED CYLINDRICAL PART                                  .17000          .210
     0020 E            RPL-SP-M1   1.00 SHOT PEEN SMALL/MED PART                                   .16131          .200
     0030 N            ZUM-CL-02   1.00 UNMASK MEDIUM SIZE CYL PART                                .05067          .062
     0040 E            RJP-PW-R1   1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001          .012
  9000        UP 01    24           .01                            LABOR STANDARD HISTORY          .000    .000    .000          0
     0010                                     PRIOR HISTORY ON OO-ALC FORM 494
     0020                               SEP 84-DELETED SUB OPS 0052,0054,0056-OCC FACTOR
     0021                               UPDATE & REVIEW - TIME WAS 0.12 HRS
     0030                               12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .00)
     0900                                     D. PARKER TECHN MANEAA 73357

TO INTERROGATE LABOR STANDARDS, INPUT

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                    LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   06/14/88   A-E046B-MM1-DY-M45  PAGE  000
          69354A     STRUT ASSY KC135 NLG                        RCC MNPRC              4S2-30-3  038-1912      82259
J      TECH S S    W F PF A/R REV
 SUB        T K   #R A FA SUPPORT   OCC <-------------------- DESCRIPTION -------------------> BASE    PFD     STD          A
     STEP D L      K C DC ELEMENT  FACT              STORED                  SUPPLEMENTAL      HOURS   TIME    HOURS    DLY PCT
-----------------------------------------------------------------------------------------------------------------------------
3C504    S  E UP EA B     J 88134   .46 PERCENT ENGR 99.9         ACTUATOR BRACKET  KC-135     .68              .31
 0001        UP 01   00            1.00                           PART NUMBER/NSN              .000    .000     .000         0
     0010                               5-72349              1620003069935
 0080        UP 01   24            1.00                           STRIP ANODIZE MED PART       .136    .033     .169    .5  25
     0010 E          ZCD-ST-S1     1.00                           STRIP ANODIZE                .12630           .156
     0020 E          RJP-PW-R1     1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001           .012
 0090        UP 01   24             .91                           ANODIZE MED PART             .460    .101     .520    .8  75
     0010 E          RWB-CV-D1     1.00 VAPOR CL (DEGR)HOOK/BASKET                             .08709           .107
     0020 E          ZPL-AN-M1     1.00 ANODIZE MEDIUM SIZE PART                               .36341           .450
     0030 E          RJP-PW-R1     1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001           .012
 9000        UP 01   24             .01                           LABOR STANDARD HISTORY       .000    .000     .000         0
     0010                                     PRIOR HISTORY ON OO-ALC FORM 494
     0020                               SEP 84-OCC FACT UPDATE/REVIEW-TIME WAS 0.64 HRS
     0030                               12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .76)
     0900                                     D. PARKER TECHN MANEAA 73357


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               LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   06/14/88    A-E046B-MM1-DY-M45  PAGE  0001
       69354A     STRUT ASSY KC135 NLG                     RCC MNPRC              4S2-30-3  038-1912      82259
OPER   TECH S S    W F PF A/R REV
  SUB       T K  #R A FA SUPPORT   OCC <--------------------- DESCRIPTION ---------------------> BASE   PFD   STD          A
     STEP D L    K C DC ELEMENT  FACT            STORED                 SUPPLEMENTAL            HOURS  TIME  HOURS   DLY PCT C
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RC510   S  E UP EA B    J 88154  .63 PERCENT ENGR 99.9          OLED CAM UP & LOWER             .63           .40
  0001       JB 01    00         .00                            PART NUMBER/ NSN                .000   .000   .000         0
     0010                            158662            1620007871753
     0020                            5-83012-1         1620005934049
  0073       UP 01    24         1.00                           DEGREASE                        .097   .023   .120        19
     0010 E            RWB-CV-D1 1.00 VAPOR CL (DEGR)HOOK/BASKET                                .08709        .107
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001        .012
  0077       UP 01    24         1.00                           GRIT BLAST                      .111   .027   .139        22
     0010 E            RPL-SB-M2 1.00 SANDBLAST MED PART WALK-IN B                              .10180        .126
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001        .012
  0080       UP 01    24         1.00                           PHOSPHATE COAT MED PART         .132   .032   .164   .3   26
     0010 E            RPL-PK-B1 1.00 PARKERIZE SMALL/MED PART                                  .12217        .151
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001        .012
  0090       UP 01    24         1.00                           BAKE PHOSPHATE MED PART         .171   .041   .213  9.0   33
     0010 E            ZPL-BK-M1 1.00 BAKE MED/LRG SIZE PART                                    .16175        .200
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001        .012
  9000       UP 01    24         .01                            LABOR STANDARD HISTORY          .000   .000   .000         0
     0010                                  PRIOR HISTORY ON OO-ALC FORM 494
     0020                            SEP 84-DELETED SUB OF 0040 - OCC FACTOR
     0021                            UPDATE & REVIEW - TIME WAS 0.19 HRS
     0030                            12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .09)
     0900                                  D. PARKER TECHN MANEAA 73357


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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 06/14/88 A-E046B-MM1-DY-M45 PAGE 0001

69354A STRUT ASSY KC135 NLG RCC MNPRC 4S2-30-3 038-1912 82259

SUB STEP	TECH S S T K D L	W F #R A K C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
RC512	S E	UP EA R		J 88161	.71	PERCENT ENGR 98.0	PLATE OUTER CYL KC135 NLG	1.93		1.37			
0001		UP 01	00		.00		PART NUMBER/NSN	.000	.000	.000		0	
0010						7327022-30	1620001954810						
0060		UP 01	24		.71		STRIP ANODIZE LARGE PART	.073	.012	.064	.5	3	
0010	E			ZCD-ST-S1	.50		STRIP ANODIZE	.12630		.078			
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0064		UP 01	24		.59		STRIP ANODIZE LARGE PART	.073	.010	.054	.5	3	
0010	E			ZCD-ST-S1	.50		STRIP ANODIZE	.12630		.078			
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0170		UP 01	24		.94		DEGREASE	.150	.034	.176		9	
0010	E			RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174			
0020	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0180		UP 01	24		.94		SHOTPEEN LARGE PART/MASK	.193	.044	.225		12	
0010	E			ZMA-CL-04	.34	MASK V/LRG CYL TYPE PART		.32667		.137			
0020	E			RPL-SP-M1	.34	SHOT PEEN SMALL/MED PART		.16131		.068			
0030	N			ZUM-CL-02	.34	UNMASK MEDIUM SIZE CYL PART		.05067		.021			
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0183		UP 01	24		.76		SHOTPEEN LARGE PART/MASK	.193	.035	.182		9	
0010	E			ZMA-CL-04	.34	MASK V/LRG CYL TYPE PART		.32667		.137			
0020	E			RPL-SP-M1	.34	SHOT PEEN SMALL/MED PART		.16131		.068			
0030	N			ZUM-CL-02	.34	UNMASK MEDIUM SIZE CYL PART		.05067		.021			
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0185		UP 01	24		.05		SHOTPEEN LARGE PART/MASK	.193	.002	.012		1	
0010	E			ZMA-CL-04	.34	MASK V/LRG CYL TYPE PART		.32667		.137			
0020	E			RPL-SP-M1	.34	SHOT PEEN SMALL/MED PART		.16131		.068			
0030	N			ZUM-CL-02	.34	UNMASK MEDIUM SIZE CYL PART		.05067		.021			
0040	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0190		UP 01	24		.59		CLEAN SHOT PEEN	.115	.016	.084		4	
0010	E			RLG-CS-02	1.00	CLEAN ANY NONFERROUS PART		.11535		.143			
0200		UP 01	24		.29		POLISH STEER COLLAR AREA	.093	.006	.034		2	
0010	E			RLG-RS-P5	1.00	POLISH PLATED SURF OUTER CYL		.08737		.108			
0020	E			RJP-PW-F1	1.00	SIGN OFF WORK CONTROL DOC		.00601		.007			
0210		UP 01	24		.21		POLISH TOW LUG AREA	.093	.005	.024		1	
0010	E			RLG-RS-P5	1.00	POLISH PLATED SURF OUTER CYL		.08737		.108			
0020	E			RJP-PW-F1	1.00	SIGN OFF WORK CONTROL DOC		.00601		.007			
0230		UP 01	24		.88		ANODIZE LARGE PART	.307	.065	.335	.8	17	
0010	E			RWB-CV-D1	.50	VAPOR CL (DEGR)HOOK/BASKET		.08709		.053			
0020	E			ZPL-AN-L1	.50	ANODIZE LARGE SIZE PART		.50714		.314			
0030	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0232		UP 01	24		.05		ANODIZE LARGE PART	.307	.004	.019	.8	1	
0010	E			RWB-CV-D1	.50	VAPOR CL (DEGR)HOOK/BASKET		.08709		.053			
0020	E			ZPL-AN-L1	.50	ANODIZE LARGE SIZE PART		.50714		.314			
0030	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0245		UP 01	24		.38		HARD ANODIZE LARGE PART	1.446	.132	.682	.8	35	
0010	E			RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
0020	E			RPL-AN-H4	1.00	HARD ANODIZE LARGE PART		1.34921		1.673			
0030	E			RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0265		UP 01	24		.12		ALODINE LARGE PART	.309	.009	.046		2	
0010	E			RPL-AL-L1	1.00	ALODINE LARGE PART - HOIST		.29943		.371			

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0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                    .01001         .012
0        UP 01    24            .01                               LABOR STANDARD HISTORY           .000    .000      .000          0
0010                                    PRIOR HISTORY ON OO-ALC FORM 494
0020                             SEP 84-ADDED SUB OP 0055, OCC FACTOR UPDATE
0021                             AND REVIEW - TIME WAS 3.00 HRS
0030                             12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS 2.68)
0900                                    D. PARKER TECHN MANEAA 73357

O INTERROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR
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                 LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   06/14/88   A-E046B-MM1-DY-M45  PAGE  0001
      69354A    STRUT ASSY KC135 NLG                      RCC MNPRC                 4S2-30-3  038-1912     82259
OPER   TECH S S   W F PF A/R REV
  SUB       T K  #R A FA SUPPORT   OCC <------------------- DESCRIPTION -------------------> BASE   PFD    STD          A
      STEP D L    K C DC ELEMENT  FACT            STORED                  SUPPLEMENTAL        HOURS  TIME   HOURS   DLY PCT C
--------------------------------------------------------------------------------------------------------------------------
RC517    S  E UP EA B    J 88159  .05 PERCENT ENGR 97.5          PLATE LOWER GEAR NUT KC135 N  1.64           .08
  0001        UP 01   00          .00                            PART NUMBER/NSN              .000   .000   .000        0
      0010                            158665          5365007660478LE
  0032        UP 01   24         1.00                            DEGREASE                     .097   .023   .120        7
      0010 E           RWB-CV-D1 1.00 VAPOR CL (DEGR)HOOK/BASKET                              .08709        .107
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0034        UP 01   24          .95                            STRIP CAD                    .262   .060   .309   .5  19
      0010 E           ZCD-ST-M1 1.00 STRIP CAD ID/OD MED/LRG PART                            .25260        .313
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0036        UP 01   24          .05                            STRIP RUST                   .262   .003   .016   .3   1
      0010 E           ZCD-ST-M1 1.00                            STRIP RUST                   .25260        .313
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0038        UP 01   24         1.00                            GRIT BLAST                   .111   .027   .139        8
      0010 E           RPL-SB-M2 1.00 SANDBLAST MED PART WALK-IN B                            .10180        .126
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0040        UP 01   24          .05                            VAC CAD MED PART             .080   .001   .005  1.0   0
      0010 E           ZPL-VC-S1 1.20 VAC CAD PLATE SMALL PART     OCC FOR MED SIZED PART     .05856        .087
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0050        UP 01   24          .90                            CAD PLATE                    .620   .134   .693       42
      0010 E           ZPL-CD-M1 1.00 CADMIUM PLATE MEDIUM PART                               .61058        .757
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
     0        UP 01   24          .90                            BAKE AFTER CAD PLATE         .171   .037   .192 38.0  12
      0010 E           ZPL-BK-M1 1.00 BAKE MED/LRG SIZE PART                                  .16175        .200
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0070        UP 01   24          .95                            CHROMATE CONVERSION(IRIDITE) .106   .024   .125        8
      0010 E           ZPL-IR-M1 1.00 IRIDITE MEDIUM PART-HOIST                               .09635        .119
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                            .01001        .012
  0083        UP 01   24          .05                            I.V.D. ALUMINUM PLATE        .450   .005   .028  1.0   2
      0010 N                     1.00                            I.V.D. PLATE                 .44000        .545
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC/                           .01001        .012
  0087        UP 01   24          .05                            ALODINE I.V.D. ALUM PLATE    .230   .003   .014        1
      0010 N                     1.00                            ALODINE                      .22000        .272
      0020 E           RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC/                           .01001        .012
  9000        UP 01   24          .01                            LABOR STANDARD HISTORY       .000   .000   .000        0
      0010                                  PRIOR HISTORY ON OO-ALC FORM 494
      0020                            SEP 84-DELETED SUB OPS 0052,0054,0056-OCC FACTOR
      0021                            UPDATE & REVIEW - TIME WAS 0.12 HRS
      0030                            12MAR86 OCC FACTOR UPDATE/REVIEW (TIME WAS .00)
      0900                                  D. PARKER TECHN MANEAA 73357


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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                      LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   07/14/88    A-E046B-HM1-DY-M45  PAGE  0001
      69354A    STRUT ASSY KC135 NLG                        RCC MNPRC                 452-30-3  038-1912    82259
      TECH S S    W F PF A/R REV
 B         T K  #R A FA SUPPORT   OCC <-------------------- DESCRIPTION -------------------->  BASE    PFD    STD              A
      STEP D L    K C DC ELEMENT  FACT           STORED                   SUPPLEMENTAL         HOURS   TIME   HOURS    DLY PCT C
--------------------------------------------------------------------------------------------------------------------------------
RC523     S  E UP EA B    J 88160  2.00 PERCENT ENGR 97.5          PLATE TRUNNION PIN KC-135 N    1.69            3.38
  0001        UP 01    00          .00                             PART NUMBER/NSN                .000   .000    .000          0
     0010                                6-68001           1620003069946
     0020                                6-68002           1620003069947
     0030                                7729421-01        1620010544789
     0040                                7729421-03        1620010544789
  0022        UP 01    24         1.00                             DEGREASE                       .097   .023    .120          7
     0010 E             SWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                                .08709         .107
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0024        UP 01    24          .95                             STRIP CAD                      .262   .060    .309   .5    18
     0010 E             ZCD-ST-M1  1.00 STRIP CAD ID/OD MED/LRG PART                              .25260         .313
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0026        UP 01    24          .05                             STRIP RUST                     .262   .003    .016   .3     1
     0010 E             ZCD-ST-M1  1.00                            STRIP RUST                     .25260         .313
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0028        UP 01    24         1.00                             GRIT BLAST                     .111   .027    .139          8
     0010 E             RPL-SB-M2  1.00 SANDBLAST MED PART WALK-IN B                              .10180         .126
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0030        UP 01    24          .95                             CAD PLATE                      .620   .141    .731         43
     0010 E             ZPL-CD-M1  1.00 CADMIUM PLATE MEDIUM PART                                 .61058         .757
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0040        UP 01    24          .95                             BAKE AFTER CAD PLATE           .171   .039    .202 38.0    12
     0010 E             ZPL-BK-M1  1.00 BAKE MED/LRG SIZE PART                                    .16175         .200
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0050        UP 01    24         1.00                             CHROMATE CONVERSION(IRIDITE)   .106   .026    .132          8
     0010 E             ZPL-IR-M1  1.00 IRIDITE MEDIUM PART-HOIST                                 .09635         .119
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                              .01001         .012
  0063        UP 01    24          .05                             I.V.D. ALUMINUM PLATE          .450   .005    .023  1.0     2
     0010 N                       1.00                             I.V.D. PLATE                   .44000         .545
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                             .01001         .012
  0067        UP 01    24          .05                             ALODINE I.V.D. ALUM PLATE      .230   .003    .014          1
     0010 N                       1.00                             ALODINE                        .22000         .272
     0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                             .01001         .012
  9000        UP 01    24          .01                             LABOR STND HISTORY             .000   .000    .000          0
     0010                               12MAR86 UPDATE WITHOUT CHANGE (TIME WAS .38)
     0900                                     D. PARKER TECHN MANEAA 73357


TO INTERROGATE LABOR STANDARDS, INPUT

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LABOR STANDARD OPERATION RESOURCE STANDARD AND METHOD ANALYSIS 09/06/88 A-E046B-MM1-BY-M45 PAGE 0001

17143A STRUT B-52 MLG * RCC MNPRC 4S1-57-3 81195

PC. SUB	STEP	TECH	S T D	S K L	W #R K	F A A C	PF FA DC	A/R REV SUPPORT ELEMENT	OCC FACT	DESCRIPTION STORED	SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
C001		S	E	UP	EA	B		J 88230	.83	PERCENT ENGR 83.8	OUTER CYL. B52M	3.09		2.56			
0001				UP	01.		00		.00		PART NUMBER/NSN	.000	.000	.000		0	
	0010									7027516-10	1620002421514						
0527				UP	01		24		1.00		DEGREASE	.097	.023	.120		4	
	0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
	0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0530				UP	01		24		1.00		SHOTPEEN MED PART / MASK	.264	.063	.328		11	
	0010		E					ZMA-CL-02	.25	MASK MED CYLINDRICAL PART	OCC. 4 EA OPERATIONS	.17000		.052			
	0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
	0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
	0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0540				UP	01		24		1.00		SHOTPEEN MED PART / MASK	.264	.063	.328		11	
	0010		E					ZMA-CL-02	.25	MASK MED CYLINDRICAL PART	OCC. 4 EA OPERATIONS	.17000		.052			
	0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
	0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
	0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0550				UP	01		24		1.00		SHOTPEEN MED PART / MASK	.264	.063	.328		11	
	0010		E					ZMA-CL-02	.25	MASK MED CYLINDRICAL PART	OCC. 4 EA OPERATIONS	.17000		.052			
	0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
	0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
	0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0				UP	01		24		1.00		SHOTPEEN MED PART / MASK	.264	.063	.328		11	
	0010		E					ZMA-CL-02	.25	MASK MED CYLINDRICAL PART	OCC. 4 EA OPERATIONS	.17000		.052			
	0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
	0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
	0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0565				UP	01		24		1.00		HONE I.D.	.485	.116	.602		19	
	0010		E					RBW-SU-G1	1.00	S/U FOR BENCH WORK GENERAL		.27525		.341			
	0020		N						1.00		HONE I.D.	.20000		.248			
	0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0570				UP	01		24		.50		POLISH BEARING LANDS	.283	.034	.176		6	
	0010		E					RLG-RS-P8	1.00	POLISH PLATED SURF OUTER CYL		.27306		.338			
	0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0580				UP	01		24		.50		POLISH STEER BEARING LANDS	.283	.034	.176		6	
	0010		E					RLG-RS-P8	1.00	POLISH PLATED SURF OUTER CYL		.27306		.338			
	0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0620				UP	01		24		1.00		ANODIZE MED PART	.460	.111	.571	.8	18	
	0010		E					RWB-CV-D1	1.00	VAPOR CL (DEGR)HOOK/BASKET		.08709		.107			
	0020		E					ZPL-AN-M1	1.00	ANODIZE MEDIUM SIZE PART		.36341		.450			
	0030		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0640				UP	01		24		1.00		ALODINE MED PART	.109	.026	.136		4	
	0010		E					RPL-AL-S1	1.00	ALODINE 1ST SMALL ALUM PART		.09953		.123			
	0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
9000				UP	01		24		.01		LABOR STANDARD HISTORY	.000	.000	.000		0	
	0010									PRIOR HISTORY ON OO-ALC 494 FORM							
	0020									25FEB83 NEW OCC. FACTOR STUDY UPDATE 1.51							
	0021									01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD> 2.00							
	0022									05DEC84 ADD UNMASK ELEM ZUMCPV1 <OLD STD> 2.10							
	0023									23JUL85 NEW OCC FACTORS & REVIEW <OLD STD> 2.16							

0024 18 FEB 87 NEW OCC FACTORS & REVIEW OLD STD 2.31
0900 CLINTON BENTLEY TECH MANEL 3357

INTERROGATE LABOR STANDARDS. INPUT

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LABOR STANDARD OPERATION [illegible]URCE STANDARD AND METHOD ANALYSIS 11/16/[illegible] A-E946B-MM1-DY-M45 PAGE 0001

17143Q- STRUT B-52 MLG RCC MNPRC 4S1-57-3 81195

ER SUB STEP	TECH	S T D	S K L	W #R K	F A C	PF FA DC	A/R SUPPORT ELEMENT	REV OCC FACT	DESCRIPTION STORED	DESCRIPTION SUPPLEMENTAL	BASE HOURS	PFD TIME	STD HOURS	DLY	PCT	A C
1	S	E	UP	EA	B		J 88230	.92	PERCENT ENGR 80.0	INNER CYL. B52M	6.89		6.34			
0001			UP	01		00		.00		PART NUMBER/NSN	.000	.000	.000			0
0010									25-4204	1620006525469						
0020									5-85123-6	1620006582588						
0278			UP	01		24		1.00		DEGREASE	.150	.036	.187			3
0010		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0279			UP	01		24		.95		STRIP CAD	.262	.060	.309	.5		4
0010		E					ZCD-ST-M1	1.00	STRIP CAD ID/OD MED/LRG PART		.25260		.313			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0282			UP	01		24		.05		STRIP RUST	.262	.003	.016	.3		0
0010		E					ZCD-ST-M1	1.00		STRIP RUST	.25260		.313			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0285			UP	01		24		.34		STRIP CHROME LARGE PART O.D.	.363	.030	.153	24.0		2
0010		E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0300			UP	01		24		.25		STRIP CHROME LARGE PART O.D.	.363	.022	.113	24.0		2
0010		E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0320			UP	01		24		.17		STRIP CHROME MED PART O.D.	.080	.003	.017	24.0		0
0010		E					ZCR-ST-M2	.20	STRIP CHROME OD MED/LRG PART	OCC. 5 EA OPERATIONS	.35303		.087			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0340			UP	01		24		.25		STRIP CHROME MED PART O.D.	.080	.005	.025	24.0		0
0010		E					ZCR-ST-M2	.20	STRIP CHROME OD MED/LRG PART	OCC. 5 EA OPERATIONS	.35303		.087			
[illegible]020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
[illegible]			UP	01		24		.42		STRIP CHROME LARGE PART O.D.	.363	.037	.189	24.0		3
0010		E					ZCR-ST-M2	1.00	STRIP CHROME OD MED/LRG PART		.35303		.437			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0520			UP	01		24		.46		BAKE AFTER ETCH	.171	.019	.098	8.0		1
0010		E					ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0550			UP	01		24		.50		DEGREASE	.150	.018	.094			1
0010		E					RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174			
0020		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0560			UP	01		24		1.00		SHOTPEEN LARGE PART/MASK	.548	.132	.680			10
0010		E					ZMA-CL-04	1.00	MASK V/LRG CYL TYPE PART		.32667		.405			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0570			UP	01		24		1.00		SHOTPEEN LARGE PART/MASK	.548	.132	.680			10
0010		E					ZMA-CL-04	1.00	MASK V/LRG CYL TYPE PART		.32667		.405			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
0580			UP	01		24		1.00		SHOTPEEN LARGE PART/MASK	.548	.132	.680			10
0010		E					ZMA-CL-04	1.00	MASK V/LRG CYL TYPE PART		.32667		.405			
0020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			
0040		E					RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012			
[illegible]			UP	01		24		.42		SHOTPEEN LARGE PART/MASK	.264	.027	.138			2
[illegible]010		E					ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	PRORATED OVER 8 EA OPER	.32667		.052			
[illegible]020		E					RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200			
0030		N					ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062			

0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0600	UP 01	24		.25		SHOTPEEN LARGE PART/MASK	.264	.016	.082		1
0010	E -		ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	PRORATED OVER 8 EA OPER	.32667		.052		
0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200		
0030	N		ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062		
0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
	UP 01	24		.34		SHOTPEEN LARGE PART/MASK	.264	.022	.111		2
0010	E		ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	PRORATED OVER 8EA OPER	.32667		.052		
0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200		
0030	N		ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062		
0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0620	UP 01	24		.25		SHOTPEEN LARGE PART/MASK	.264	.016	.082		1
0010	E		ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	PRORATED OVER 8EA OPER	.32667		.052		
0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200		
0030	N		ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062		
0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0630	UP 01	24		.09		SHOTPEEN LARGE PART/MASK	.264	.006	.030		0
0010	E		ZMA-CL-04	.13	MASK V/LRG CYL TYPE PART	PRORATED OVER 8EA OPERATIONS	.32667		.052		
0020	E		RPL-SP-M1	1.00	SHOT PEEN SMALL/MED PART		.16131		.200		
0030	N		ZUM-CL-02	1.00	UNMASK MEDIUM SIZE CYL PART		.05067		.062		
0040	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0635	UP 01	24		.25		PREP CHROME I.D. LARGE PART	.940	.056	.291		4
0010	N			1.00		PREP CHROME I.D.	.93000		1.153		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0640	UP 01	24		.25		CHROME LARGE PART I.D.	.640	.038	.198	30.0	3
0010	N			1.00		CHROME PLATE LARGE PART	.63000		.781		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC....		.01001		.012		
0650	UP 01	24		.25		BAKE AFTER CHROME PLATE	.171	.010	.053	8.0	1
0010	E		ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0655	UP 01	24		.34		PREP CHROME LARGE PART O.D.	.152	.012	.064		1
0010	N			.20		PRORATE PREP TIME 5EA OPER	.71000		.176		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0660	UP 01	24		.34		CHROME PLATE LARGE PART O.D.	.128	.010	.054	24.0	1
0010	N			.20		PRORATE PERP TIME 5EA OPER	.59000		.146		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0675	UP 01	24		.25		PREP CHROME LARGE PART O.D.	.152	.009	.047		1
0010	N			.20		PRORATE PREP OVER 5EA OPER	.71000		.176		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0680	UP 01	24		.25		CHROME PLATE LARGE PART O.D.	.128	.008	.040	24.0	1
0010	N			.20		PRORATE CHROME 5EA OPER	.59000		.146		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0690	UP 01	24		.34		PREP CHROME LARGE PART O.D.	.152	.012	.064		1
0010	N			.20		PRORATE PREP OVER 5EA OPER	.71000		.176		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0700	UP 01	24		.34		CHROME PLATE LARGE PART O.D.	.128	.010	.054	24.0	1
0010	N			.20		PRORATE CHROME OVER 5EA OPER	.59000		.146		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0720	UP 01	24		.34		PREP CHROME LARGE PART O.D.	.152	.012	.064		1
0010	N			.20		PRORATED PREP OVER 5EA OPER	.71000		.176		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0740	UP 01	24		.34		CHROME PLATE LARGE PART O.D.	.128	.010	.054	24.0	1
0010	N			.20		PRORATE CHROME OVER 5EA OPER	.59000		.146		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0750	UP 01	24		.42		PREP CHROME LARGE PART O.D.	.152	.015	.079		1
0010	N			.20		PRORATE PREP OVER 5EA OPER	.71000		.176		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
	UP 01	24		.42		CHROME PLATE LARGE PART O.D.	.128	.013	.067	24.0	1
0010	N			.20		PRORATE CHROME OVER 5EA OPER	.59000		.146		
0020	E		RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		

	UP 01	24	.59		BAKE AFTER CHROME PLATE	.171	.024	.126	8.0	2
0010	E	ZPL-BK-M1	1.00	BAKE MED/[illegible] SIZE PART		.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0880	UP 01	24	.59		BAKE AFTER GRIND	.171	.024	.126	8.0	2
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
	UP 01	24	.59		DEGREASE	.150	.021	.110		2
0010	E	RPL-DE-L1	1.00	DEGREASE LARGE PART OR BASKT		.14095		.174		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0902	UP 01	24	.59		GRIT BLAST PRIOR TO CAD/IVD	.117	.017	.086		1
0010	E	RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST PRORATED OVER 3EA OPER		.31693		.133		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0905	UP 01	24	.67		GRIT BLAST PRIOR TO CAD/IVD	.117	.019	.098		1
0010	E	RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST PRORATED OVER 3EA OPERATION		.31693		.133		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0907	UP 01	24	1.00		GRIT BLAST PRIOR TO CAD/IVD	.117	.028	.146		2
0010	E	RPL-SB-L2	.34	SANDBLAST LARGE PART - HOIST PRORATED OVER 3EA OPER		.31693		.133		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0910	UP 01	24	.95		CAD PLATE	.824	.188	.971		14
0010	E	ZPL-CD-L1	1.00	CADMIUM PLATE LRG PART-HOIST		.81410		1.009		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0920	UP 01	24	.95		BAKE AFTER CAD PLATE	.171	.039	.202	38.0	3
0010	E	ZPL-BK-M1	1.00	BAKE MED/LRG SIZE PART		.16175		.200		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0930	UP 01	24	.95		CHROMATE CONVERSION(IRIDITE)	.117	.027	.138		2
0010	E	ZPL-IR-L1	1.00	IRIDITE LARGE PART-HOIST		.10705		.132		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC		.01001		.012		
0937	UP 01	24	.05		I.V.D. ALUMINUM PLATE	.824	.010	.051	1.0	1
0010	N		1.00		I.V.D. PLATE	.81490		1.009		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
0939	UP 01	24	.05		ALODINE I.V.D. ALUM PLATE	.425	.005	.026		0
0010	N		1.00		ALODINE	.41500		.514		
0020	E	RJP-PW-R1	1.00	REM RPL PAPRWRK SIGN OFF DOC/		.01001		.012		
9000	UP 01	00	.01		LABOR STANDARD HISTORY	.000	.000	.000		0
0010				PRIOR HISTORY ON OO-ALC 494 FORM						
0020				25FEB83 NEW OCC.FACTOR STUDY UPDATE 15						
0021				01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD> 3.67						
0022				05DEC84 ADD UNMASK ELEMENT ZUMCPV1 <OLD STD>4.89						
0023				23JUL85 NEW OCC FACTORS & REVIEW <OLD STD> 4.93						
0024				18 FEB 87 NEW OCC FACTORS & REVIEW OLD STD 5.04						
0025				20/10/87 CHANGED S/P ELIMENT EQUIP. CHANGE O/S5.74						
0900				CLINTON BENTLEY TECH MANEL 3357						

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                    LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-BY-M45  PAGE  0001
        17143A    STRUT B-52 MLG                                RCC MMPRC                  4S1-57-3                81195
JPL    TECH S S   W F PF A/R REV
  SUB       T K  #R A FA SUPPORT   OCC <------------------ DESCRIPTION -----------------> BASE   PFD    STD          A
       STEP D L   K C DC ELEMENT  FACT              STORED                 SUPPLEMENTAL    HOURS  TIME   HOURS   DLY PCT C
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RC004    S  E UP EA B    J 88230  1.63 PERCENT ENGR 94.9          STEERING BEARING B52M 2 EA     .53          .87
  0001        UP 01 . 00           .00                            PART NUMBER/NSN               .000   .000   .000        0
     0010                              9-52299-505         1620009665426
     0020                              9-52532-501         1620009072897
     0030                              9-52299-505         1620009665426
     0040                              9-52532-501         1620009072897
  0015        UP 01   24          1.00                            STRIP CAD                     .136   .033   .169  .5  32
     0010 E          ZCD-ST-S1    1.00 STRIP CAD PLATE SMALL PART                               .12630        .156
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  0083        UP 01   24          1.00                            DEGREASE                      .097   .023   .120      22
     0010 E          RWB-CV-D1    1.00 VAPOR CL (DEGR)HOOK/BASKET                               .08709        .107
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  0087        UP 01   24          1.00                            GRIT BLAST                    .046   .011   .058      11
     0010 E          RWB-CB-B1    1.00 BLAST SM PT OR BSKT V/SM PTS                             .03668        .045
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  0090        UP 01   24           .95                            CAD PLATE                     .102   .023   .120      22
     0010 E          ZPL-CD-S1    1.00 CADMIUM PLATE SMALL PART                                 .09212        .114
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
  0120        UP 01   24           .95                            CHROMATE CONVERSION(IRIDITE)  .033   .008   .040       7
     0010 E          ZPL-IR-S1    1.00 IRIDITE SMALL PART                                       .02362        .029
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001        .012
     :        UP 01   24           .05                            I.V.D. ALUMINUM PLATE         .230   .003   .014 1.0   3
     0010 N                       1.00                            I.V.D. PLATE                  .22000        .272
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                            .01001        .012
  0130        UP 01   24           .05                            ALODINE I.V.D. ALUM PLATE     .230   .003   .014       3
     0010 N                       1.00                            ALODINE                       .22000        .272
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                            .01001        .012
  9000        UP 01   24           .01                            LABOR STANDARD HISTORY        .000   .000   .000       0
     0010                              PRIOR HISTORY ON OO-ALC 494 FORM
     0020                              25FEB83 NEW OCC. FACTOR STUDY UPDATE
     0021                              01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD>  .72
     0022                              05DEC84 CHG BLAST ELEMENT TO RWBCBB1 <OLD STD> .37
     0023                              23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>    .31
     0024                              18 FEB 87 NEW OCC FACTORS & REVIEW OLD STD     .29
     0900                              CLINTON BENTLEY TECH MANEL 3357


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                                LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-DY-M45  PAGE  0001
              17143A    STRUT B-52 MLG                                   RCC MMPRC               4S1-57-3                 81195
OPER    TECH S S    W F PF A/R REV
  SUB        T K  #R A FA SUPPORT   OCC <------------------- DESCRIPTION ------------------>  BASE     PFD     STD                A
       STEP D L    K C DC ELEMENT  FACT            STORED                  SUPPLEMENTAL         HOURS    TIME    HOURS      DLY PCT C
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RC005    S  E UP EA B     J 88231   .96 PERCENT ENGR 95.7          LOWER TRIPOD LINK B52M        .64              .61
  0001        UP 01   00            .00                            PART NUMBER/NSN               .000    .000     .000            0
       0010                             25-4211             1620006099886
  0123        UP 01   24           1.00                            DEGREASE                      .097    .023     .120           19
       0010 E           RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                               .08709           .107
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
  0127        UP 01   24            .95                            STRIP CAD                     .136    .031     .161      .5   25
       0010 E           ZCD-ST-S1  1.00 STRIP CAD PLATE SMALL PART                               .12630           .156
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
  0130        UP 01   24            .05                            STRIP RUST                    .136    .002     .008      .3    1
       0010 E           ZCD-ST-S1  1.00                            STRIP RUST                    .12630           .156
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
  0135        UP 01   24           1.00                            GRIT BLAST                    .046    .011     .058            9
       0010 E           RWB-CB-B1  1.00 BLAST SM PT OR BSKT V/SM PTS                             .03668           .045
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
    40        UP 01   24            .95                            CAD PLATE                     .102    .023     .120           19
       0010 E           ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                                 .09212           .114
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
  0160        UP 01   24            .95                            BAKE AFTER CAD PLATE          .090    .021     .107  38.0   17
       0010 E           ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                               .08088           .100
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
  0200        UP 01   24            .95                            CHROMATE CONVERSION(IRIDITE)  .033    .008     .040            6
       0010 E           ZPL-IR-S1  1.00 IRIDITE SMALL PART                                       .02362           .029
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001           .012
  0213        UP 01   24            .05                            I.V.D. ALUMINUM PLATE         .230    .003     .014   1.0    2
       0010 N                      1.00                            I.V.D. PLATE                  .22000           .272
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                            .01001           .012
  0217        UP 01   24            .05                            ALODINE I.V.D. ALUM PLATE     .230    .003     .014            2
       0010 N                      1.00                            ALODINE                       .22000           .272
       0020 E           RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                            .01001           .012
  9000        UP 01   24            .01                            LABOR STANDARD HISTORY        .000    .000     .000            0
       0010                             PRIOR HISTORY ON OO-ALC 494 FORM
       0020                             25FEB83 NEW OCC. FACTOR STUDY UPDATE             .58
       0021                             01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD> .33
       0022                             05DEC84 CHG BLAST ELEM TO ZLGBC03 <OLD STD>    1.29
       0023                             23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>    1.27
       0024                             16SEPT86-DEL SUBOP 0055 WORK NOT DONE:OLD STD 1.47


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                            LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-DY-M45  PAGE  0001
          17143A     STRUT B-52 MLG                                  RCC MNPRC                   4S1-57-3                 81195
OPER    TECH S S     W F PF A/R REV
   SUB       T K    #R A FA SUPPORT   OCC <------------------- DESCRIPTION ------------------->  BASE    PFD    STD            A
       STEP  D L     K C DC ELEMENT  FACT            STORED                     SUPPLEMENTAL      HOURS   TIME   HOURS   DLY PCT C
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RC006     S  E UP EA B     J 88231  1.00 PERCENT ENGR 95.7           OUTBOARD TRIPOD LINK B52M      .64            .64
   0001        UP 01    00           .00                             PART NUMBER/NSN                .000    .000   .000          0
       0010                              5-36035-3           1620006207642
   0163        UP 01    24          1.00                             DEGREASE                       .097    .023   .120         19
       0010 E          RWB-CV-D1    1.00 VAPOR CL (DEGR)HOOK/BASKET                                 .08709         .107
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0167        UP 01    24           .95                             STRIP CAD                      .136    .031   .161   .5    25
       0010 E          ZCD-ST-S1    1.00 STRIP CAD PLATE SMALL PART                                 .12630         .156
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0170        UP 01    24           .05                             STRIP RUST                     .136    .002   .008   .3     1
       0010 E          ZCD-ST-S1    1.00                             STRIP RUST                     .12630         .156
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0175        UP 01    24          1.00                             GRIT BLAST                     .046    .011   .058          9
       0010 E          RWB-CB-B1    1.00 BLAST SM PT OR BSKT V/SM PTS                               .03668         .045
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0180        UP 01    24           .95                             CAD PLATE                      .102    .023   .120         19
       0010 E          ZPL-CD-S1    1.00 CADMIUM PLATE SMALL PART                                   .09212         .114
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0200        UP 01    24           .95                             BAKE AFTER CAD PLATE           .090    .021   .107 38.0    17
       0010 E          ZPL-BK-S1    1.00 BAKE SM PART 4HR/24HR BAKE                                 .08088         .100
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0240        UP 01    24           .95                             CHROMATE CONVERSION(IRIDITE)   .033    .008   .040          6
       0010 E          ZPL-IR-S1    1.00 IRIDITE SMALL PART                                         .02362         .029
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                               .01001         .012
   0253        UP 01    24           .05                             I.V.D. ALUMINUM PLATE          .230    .003   .014  1.0     2
       0010 N                       1.00                             I.V.D. PLATE                   .22000         .272
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                              .01001         .012
   0257        UP 01    24           .05                             ALODINE I.V.D. ALUM PLATE      .230    .003   .014          2
       0010 N                       1.00                             ALODINE                        .22000         .272
       0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                              .01001         .012
   9000        UP 01    24           .01                             LABOR STANDARD HISTORY         .000    .000   .000          0
       0010                              PRIOR HISTORY ON OO-ALC 494 FORM
       0020                              25FEB83 NEW OCC. FACTOR STUDY UPDATE            .54
       0021                              01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD> .57
       0022                              05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>    .82
       0023                              23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>    .76
       0024                              01APR86 DELETE SUB OP 0060   <OLD STD>        .80


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                LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88   A-E046B-MM1-DY-M45  PAGE  0001
      17143A    STRUT B-52 MLG                           RCC MMPRC               4S1-57-3               81195
OPER   TECH S S   W F PF A/R REV
  SUB     T K  #R A FA SUPPORT   OCC <------------------- DESCRIPTION ------------------->  BASE    PFD    STD          A
     STEP D L   K C DC ELEMENT  FACT              STORED                   SUPPLEMENTAL      HOURS   TIME   HOURS   DLY PCT C
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RC007   S  E UP EA B    J 88231  .92 PERCENT ENGR 96.4          INBOARD LINK B52M            .76            .70
  0001       UP 01   00          .00                            PART NUMBER/NSN              .000   .000    .000          0
     0010                             5-35964-3          1620000922837
  0075       UP 01   24         1.00                            DEGREASE                     .097   .023    .120         16
     0010 E            RWB-CV-D1 1.00 VAPOR CL (DEGR)HOOK/BASKET                             .08709         .107
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0080       UP 01   24          .95                            STRIP CAD                    .136   .031    .161   .5  21
     0010 E            ZCD-ST-S1 1.00 STRIP CAD PLATE SMALL PART                             .12630         .156
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0090       UP 01   24          .05                            STRIP RUST                   .136   .002    .008   .3   1
     0010 E            ZCD-ST-S1 1.00                           STRIP RUST                   .12630         .156
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0130       UP 01   24         1.00                            DEGREASE                     .097   .023    .120         16
     0010 E            RWB-CV-D1 1.00 VAPOR CL (DEGR)HOOK/BASKET                             .08709         .107
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0135       UP 01   24         1.00                            GRIT BLAST                   .046   .011    .058          8
     0010 E            RWB-CB-B1 1.00 BLAST SM PT OR BSKT W/SM PTS                           .03668         .045
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0140       UP 01   24          .95                            CAD PLATE                    .102   .023    .120         16
     0010 E            ZPL-CD-S1 1.00 CADMIUM PLATE SMALL PART                               .09212         .114
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0160       UP 01   24          .95                            BAKE AFTER CAD PLATE         .090   .021    .107 38.0  14
     0010 E            ZPL-BK-S1 1.00 BAKE SM PART 4HR/24HR BAKE                             .08088         .100
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0200       UP 01   24          .95                            CHROMATE CONVERSION(IRIDITE) .033   .008    .040          5
     0010 E            ZPL-IR-S1 1.00 IRIDITE SMALL PART                                     .02362         .029
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                           .01001         .012
  0213       UP 01   24          .05                            I.V.D. ALUMINUM PLATE        .230   .003    .014  1.0   2
     0010 N                     1.00                            I.V.D. PLATE                 .22000         .272
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC/                          .01001         .012
  0217       UP 01   24          .05                            ALODINE I.V.D. ALUM PLATE    .230   .003    .014          2
     0010 N                     1.00                            ALODINE                      .22000         .272
     0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC/                          .01001         .012
  9000       UP 01   24          .01                            LABOR STANDARD HISTORY       .000   .000    .000          0
     0010                             25FEB83 NEW OCC. FACTOR STUDY UPDATE<OLD STD>  .56
     0011                             01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD> .55
     0012                             05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>     .76
     0013                             23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>     .70
     0014                             01APT86 DELETE SUB OP 0055    <OLD STD>        .73
     0015                             19 FEB 87 NEW OCC FACTORS & REVIEW OLD STD      .73
     0900                             CLINTON BENTLEY TECH MANEL 3357


ITERROGATE LABOR STANDARDS, INPUT

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                         LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-DY-M45  PAGE  0001
        17143A     STRUT B-52 MLG                          RCC MNPRC                4S1-57-3               81195
OPER    TECH S S    W F PF A/R REV
  SUB      T K   #R A FA SUPPORT   OCC <------------------- DESCRIPTION -------------------> BASE    PFD    STD            A
    STEP D L      K C DC ELEMENT  FACT              STORED                 SUPPLEMENTAL       HOURS   TIME   HOURS    DLY PCT C
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RC008    S  N UP EA B     J 88231   .63 PERCENT ENGR 61.9           STEERING PLATE ASSY B52M        13.96          8.79
  0001        UP 01   00            .00                             PART NUMBER/NSN                 .000   .000    .000        0
     0010                               5-68457-5             1620006052768
  0070        UP 01   24           1.00                             DEGREASE                        .271   .065    .336        2
     0010 E          RWB-CV-D1    3.00 VAPOR CL (DEGR)HOOK/BASKET  OCC. 3 EA PARTS                 .08709          .323
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0080        UP 01   24            .95                             STRIP CAD                       .767   .175    .904  .5    6
     0010 E          ZCD-ST-M1    3.00 STRIP CAD ID/OD MED/LRG PARTOCC. 3 EA PARTS                 .25260          .939
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0090        UP 01   24            .05                             STRIP RUST                      .767   .009    .048  .3    0
     0010 E          ZCD-ST-M1    3.00                                OCC. 3 EA PARTS               .25260          .939
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0100        UP 01   24            .87                             STRIP CHROME MED PART O.D.     1.069   .223   1.153 24.0   8
     0010 E          ZCR-ST-M2    3.00 STRIP CHROME OD MED/LRG PART  OCC. 3 EA PARTS               .35303         1.313
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0190        UP 01   24            .54                             BAKE AFTER ETCH                 495    .064    .332  8.0   2
     0010 E          ZPL-BK-M1    3.00 BAKE MED/LRG SIZE PART        OCC. 3 EA PARTS                .6175          .601
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0220        UP 01   24            .54                             DEGREASE                        .271   .035    .182        1
     0010 E          RWB-CV-D1    3.00 VAPOR CL (DEGR)HOOK/BASKET    OCC. 3 EA PARTS               .08709          .323
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0230        UP 01   24            .87                             GRIT BLAST                      .315   .066    .340        2
     0010 E          RPL-SB-M2    3.00 SANDBLAST MED PART WALK-IN B  OCC. 3 EA PARTS               .10180          .378
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0235        UP 01   24            .87                             PREP FOR CHROME MED PART O.D   2.140   .447   2.309       17
     0010 N                       3.00                               OCC. 3 EA PARTS               .71000         2.641
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0240        UP 01   24            .87                             CHROME PLATE MED PART O.D.     1.780   .372   1.920 24.0  14
     0010 N                       3.00                               OCC. 3 EA PARTS               .59000         2.194
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0250        UP 01   24            .87                             BAKE AFTER CHROME PLATE         .495   .103    .534  8.0   4
     0010 E          ZPL-BK-M1    3.00 BAKE MED/LRG SIZE PART        OCC. 3 EA PARTS               .16175          .601
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0255        UP 01   24           1.00                             GRIT BLAST                      .315   .076    .391        3
     0010 E          RPL-SB-M2    3.00 SANDBLAST MED PART WALK-IN B  OCC. 3 EA PARTS               .10180          .378
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0260        UP 01   24            .95                             CAD PLATE                      1.841   .420   2.170       16
     0010 E          ZPL-CD-M1    3.00 CADMIUM PLATE MEDIUM PART     OCC. 3 EA PARTS               .61058         2.271
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0280        UP 01   24            .95                             BAKE AFTER CAD PLATE            .495   .113    .583 38.0   4
     0010 E          ZPL-BK-M1    3.00 BAKE MED/LRG SIZE PART        OCC. 3 EA PARTS               .16175          .601
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
  0302        UP 01   24            .95                                                             .271   .062    .320        2
     0010 E          RWB-CV-D1    3.00 VAPOR CL (DEGR)HOOK/BASKET    OCC. 3 EA PARTS               .08709          .323
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
    3         UP 01   24            .05                             I.V.D. ALUMINUM PLATE          1.330   .016    .082  1.0   1
     0010 N                       3.00                               OCC. 3 EA PARTS               .44000         1.636
     0020 E          RJP-PW-R1    1.00 REM RPL PAPRWRK SIGN OFF DOC/                               .01001          .012
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0305      UP 01   00            .54                                BRUSH PLATE I.D.              .568   .000    .307        2
   0010 E         RLG-RS-B2  3.00 BRUSH PLATE ID OF CYLINDER    OCC. 3 EA PARTS               .18615          .558
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .010
[illegible] UP 01 24            .54                                BAKE AFTER NICKEL             .495   .064    .332 38.0   2
   0010 E         ZPL-BK-M1  3.00 BAKE MED/LRG SIZE PART         OCC. 3 EA PARTS               .16175          .601
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
0320      UP 01   24           1.00                                DRY FILM LUBE MED PART        .816   .196   1.013  2.0   7
   0010 N                      3.00                                 OCC. 3 EA PARTS              .27233         1.013
   0290
0340      UP 01   24           1.00                                BAKE ANY 1 HR BAKE            .252   .061    .313  2.0   2
   0010 E         ZPL-BK-S1  3.00 BAKE SM PART 4HR/24HR BAKE     OCC. 3 EA PARTS               .08088          .300
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
0360      UP 01   24            .95                                CHROMATE CONVERSION(IRIDITE)  .299   .068    .352        3
   0010 E         ZPL-IR-M1  3.00 IRIDITE MEDIUM PART-HOIST      OCC. 3 EA PARTS               .09635          .358
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                                .01001          .012
0370      UP 01   24            .05                                ALODINE I.V.D. ALUM PLATE     .670   .008    .042        0
   0010 N                      3.00                                 OCC. 3 EA PARTS              .22000          .818
   0020 E         RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                               .01001          .012
9000      UP 01   24            .01                                LABOR STANDARD HISTORY        .000   .000    .000        0
   0010                               PRIOR HISTORY ON 00-ALC 494 FORM
   0020                               25FEB83 NEW OCC.FACTOR STUDY UPDATE          10.69
   0021                               01AUG84 REWRITE STD W/NEW OCC FACTOR<OLD STD>10.68
   0022                               08AUG84 ADD SUB O/P 305 & 310 OCC EST<OLD STD>7.49
   0023                               05DEC84 CHG BLAST ELEMENT TO ZLGBC03<OLD STD>7.89
   0024                               23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>   7.81
   0025                               01APR86 DELETE SUB OP 0092     <OLD STD>     8.23
   0026                               23 FEB 87 NEW OCC FACTOR & REVIEW OLD STD     8.20
   0027                               31 MARCH 87 ADDED SUBOP 0255 <OLD STD 12.54>
   0900                                      KERRY COOP MANEL TECHN 73357


TO INTERROGATE LABOR STANDARDS, INPUT

 RCC PRD NROP NR
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                  LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-DY-M45  PAGE  0001
        17143A    STRUT B-52 MLG                             RCC MNPRC                 4S1-57-3              81195
PER   TECH S S    W F PF A/R REV
 SUB       T K   #R A FA SUPPORT   OCC <------------------ DESCRIPTION ------------------>  BASE   PFD    STD            A
      STEP D L    K C DC ELEMENT  FACT             STORED                SUPPLEMENTAL       HOURS  TIME   HOURS    DLY PCT C
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C009    S  E UP EA B     J 88232  1.75 PERCENT ENGR 97.5          TORQUE ARM 2 EA          1.68          2.94
 0001      UP 01   00              .00                           PART NUMBER/NSN           .000   .000   .000          0
   0010                                1-80721-1          1620003170530
 0085      UP 01   24             1.00                           DEGREASE                  .097   .023   .120          7
    0010 E             RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                          .08709        .107
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0090      UP 01   24              .95                           STRIP CAD                 .262   .060   .309    .5   18
    0010 E             ZCD-ST-M1  1.00 STRIP CAD ID/OD MED/LRG PART                        .25260        .313
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0093      UP 01   24              .05                           STRIP RUST                .262   .003   .016    .3    1
    0010 E             ZCD-ST-M1  1.00                           STRIP RUST                .25260        .313
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0095      UP 01   24             1.00                           GRIT BLAST                .111   .027   .139          8
    0010 E             RPL-SB-M2  1.00 SANDBLAST MED PART WALK-IN B                        .10180        .126
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0100      UP 01   24              .95                           CAD PLATE                 .620   .141   .731         43
    0010 E             ZPL-CD-M1  1.00 CADMIUM PLATE MEDIUM PART                           .61058        .757
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
  120      UP 01   24              .95                           BAKE AFTER CAD PLATE      .171   .039   .202  38.0   12
    0010 E             ZPL-BK-M1  1.00 BAKE MED/LRG SIZE PART                              .16175        .200
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0140      UP 01   24              .95                           CHROMATE CONVERSION(IRIDITE)  .106  .024  .125         7
    0010 E             ZPL-IR-M1  1.00 IRIDITE MEDIUM PART-HOIST                           .09635        .119
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0160      UP 01   24              .05                           I.V.D. ALUMINUM PLATE     .450   .005   .028   1.0    2
    0010 N                        1.00                           I.V.D. PLATE              .44000        .545
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                       .01001        .012
 0170      UP 01   24              .05                           ALODINE I.V.D. ALUM PLATE .230   .003   .014          1
    0010 N                        1.00                           ALODINE                   .22000        .272
    0020 E             RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                       .01001        .012
 9000      UP 01   24              .01                           LABOR STANDARD HISTORY    .000   .000   .000          0
    0010                               PRIOR HISTORY ON OO-ALC 494 FORM
    0020                               25FEB83 NEW OCC. FACTOR STUDY UPDATE          .86
    0021                               01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD> .74
    0022                               05DEC84 CHG BLAST TO RWBCBB2      <OLD STD>   2.05
    0023                               23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>   2.02
    0024                               01APR86 DELETE SUB OP 0085   <OLD STD>       2.58
    0025                               19 FEB 87 NEW OCC FACTORS & REVIEW OLD STD    2.56
    0900                               CLINTON BENTLEY TECH MANEL 3357


TO INTERROGATE LABOR STANDARDS, INPUT

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                LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-DY-M45  PAGE  0001
    17143A     STRUT B-52 MLG                                RCC MNPRC               4S1-57-3                81195
PE..  TECH S S    W F PF A/R REV
 SUB       T K  #R A FA SUPPORT    OCC <------------------- DESCRIPTION ------------------->  BASE    PFD    STD            A
    STEP D L     K C DC ELEMENT   FACT           STORED                    SUPPLEMENTAL        HOURS   TIME   HOURS   DLY PCT C
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2010   S  E UP EA B    J 88232   .42 PERCENT ENGR 86.8           CENTERING CAM B52M              1.53            .64
 0001       UP 01   00           .00                              PART NUMBER/NSN                 .000   .000    .000        0
    0010                             25-4214-501           1620007330993
 0070       UP 01   24          1.00                              DEGREASE                        .097   .023    .120        8
    0010 E            RWB-CV-D1 1.00 VAPOR CL (DEGR)HOOK/BASKET                                   .08709         .107
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0080       UP 01   24          1.00                              STRIP SILVER                    .252   .061    .313 24.0  20
    0010 E            ZCR-ST-S1 1.00                              STRIP SILVER                    .24234         .300
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0132       UP 01   24          1.00                              DEGREASE                        .097   .023    .120        8
    0010 E            RWB-CV-D1 1.00 VAPOR CL (DEGR)HOOK/BASKET                                   .08709         .107
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0134       UP 01   00          1.00                              PREP FOR SILVER PLATE           .177   .000    .177       12
    0010 N                      1.00                              PREP SILVER                     .16700         .167
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .010
 0136       UP 01   24          1.00                              GRIT BLAST                      .046   .011    .058        4
    0010 E            RWB-CB-B1 1.00 BLAST SM PT OR BSKT V/SM PTS                                 .03668         .045
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0140       UP 01   24          1.00                              SILVER PLATE SMALL PART         .239   .057    .297 24.0  19
    0010 E            ZPL-SL-S1 1.00 SILVER PL 1ST SM OR MED PART                                 .22924         .284
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
            UP 01   24          1.00                              BAKE AFTER SILVER               .090   .022    .113  8.0   7
    0010 E            ZPL-BK-S1 1.00 BAKE SM PART 4HR/24HR BAKE                                   .08088         .100
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0155       UP 01   24          1.00                              GRIT BLAST                      .046   .011    .058        4
    0010 E            RWB-CB-B1 1.00 BLAST SM PT OR BSKT V/SM PTS                                 .03668         .045
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0160       UP 01   24          1.00                              PHOSPHATE COAT SMALL PART       .132   .032    .164   .3  11
    0010 E            RPL-PK-B1 1.00 PARKERIZE SMALL/MED PART                                     .12217         .151
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 0180       UP 01   24          1.00                              BAKE AFTER PHOSPHATE SM PART    .090   .022    .113  9.0   7
    0010 E            ZPL-BK-S1 1.00 BAKE SM PART 4HR/24HR BAKE                                   .08088         .100
    0020 E            RJP-PW-R1 1.00 REM RPL PAPRWRK SIGN OFF DOC                                 .01001         .012
 9000       UP 01   24           .01                              LABOR STANDARD HISTORY          .000   .000    .000        0
    0010                             PRIOR HISTORY ON OO-ALC 494 FORM
    0020                             25FEB83 NEW OCC.FACTOR STUDY UPDATE          1.76
    0030                             14OCT83 UPGRADE TO'E' STANDARD   <OLD STD>    1.09
    0031                             01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD>1.20
    0032                             05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>   2.07
    0033                             23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>   1.86
    0034                             27 FEB 87 NEW OCC FACTORS & REVIEW OLD STD    1.78
    0035                             12 MAY 87 DELETED SUB 0200 &  CHANGED SUB 0160
    0036                             FROM CAD PLT TO PHOSPHATE COAT <OLD STD 4.23>
    0900                                   KERRY COOP TECH MANEL 3357

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RCC PRD NROP NR
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                    LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88    A-E046B-MM1-DY-M45  PAGE  0001
       17143A      STRUT B-52 MLG                        RCC MNPRC                   4S1-57-3               81195
PER    TECH S S     W F PF A/R REV
  SUB       T K   #R A FA SUPPORT   OCC <------------------ DESCRIPTION ----------------->  BASE    PFD    STD            A
     STEP D L      K C DC ELEMENT  FACT            STORED                   SUPPLEMENTAL     HOURS   TIME   HOURS   DLY PCT C
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C013     S  E UP EA B    J 88235  2.00 PERCENT ENGR 95.7            TRUNNION CAP B52M 2 EA      .64            1.28
  0001       UP 01    00           .00                              PART NUMBER/NSN             .000   .000    .000         0
     0010                              9-52976              1620003270505
     0020                              9-52977              1620003270506
  0023       UP 01    24           1.00                             DEGREASE                    .097   .023    .120        19
     0010 E            RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                               .08709         .107
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
  0025       UP 01    24            .95                             STRIP CAD                   .136   .031    .161   .5   25
     0010 E            ZCD-ST-S1  1.00 STRIP CAD PLATE SMALL PART                               .12630         .156
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
  0027       UP 01    24            .05                             STRIP RUST                  .136   .002    .008   .3    1
     0010 E            ZCD-ST-S1  1.00                              STRIP RUST                  .12630         .156
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
  0030       UP 01    24           1.00                             GRIT BLAST                  .046   .011    .058         9
     0010 E            RWB-CB-B1  1.00 BLAST SM PT OR BSKT V/SM PTS                             .03668         .045
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
     0       UP 01    24            .95                             CAD PLATE                   .102   .023    .120        19
     0010 E            ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                                 .09212         .114
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
  0043       UP 01    24            .95                             BAKE AFTER CAD PLATE        .090   .021    .107  38.0  17
     0010 E            ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                               .08088         .100
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
  0045       UP 01    24            .95                             CHROMATE CONVERSION(IRIDITE) .033  .008    .040         6
     0010 E            ZPL-IR-S1  1.00 IRIDITE SMALL PART                                       .02362         .029
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                             .01001         .012
  0048       UP 01    24            .05                             I.V.D. ALUMINUM PLATE       .230   .003    .014  1.0    2
     0010 N                       1.00                              I.V.D. PLATE                .22000         .272
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                            .01001         .012
  0049       UP 01    24            .05                             ALODINE I.V.D. ALUM PLATE   .230   .003    .014         2
     0010 N                       1.00                              ALODINE                     .22000         .272
     0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                            .01001         .012
  9000       UP 01    24            .01                             LABOR STANDARD HISTORY      .000   .000    .000         0
     0010                              PRIOR HISTORY ON OO-ALC 494 FORM
     0020                              25FEB83 UPDATE OPERATION LINE 2YR REVIEW       .00
     0021                              01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD> .00
     0022                              05DEC84 CHG BLAST ELEM TO RWBCBB1 <OLD STD>    .07
     0023                              23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>    .06
     0024                              04AUG86 NEW OCC FACTOR STUDY  <OLD STD>       .24
     0025                              19 FEB 87 NEW OCC FACTORS & REVIEW OLD STD     .80
     0900                              CLINTON BENTLEY TECH MANEL 3357


  RROGATE LABOR STANDARDS, INPUT

RCC PRD NROP NR
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--X----X--->
 890123456  ELSE PUT IN END

                LABOR STANDARD  OPERATION RESOURCE STANDARD AND METHOD ANALYSIS   09/06/88   A-E046B-MM1-DY-M45  PAGE  0001
    17143A     STRUT B-52 MLG                               RCC MNPRC               4S1-57-3             81195
'ER  TECH S S   W F PF A/R REV
 SUB     T K  #R A FA SUPPORT   OCC <------------------ DESCRIPTION ------------------>  BASE    PFD    STD              A
    STEP D L   K C DC ELEMENT  FACT             STORED                  SUPPLEMENTAL     HOURS   TIME   HOURS   DLY PCT C
---------------------------------------------------------------------------------------------------------------------------
:014   S  E UP EA B    J 88235  .54 PERCENT ENGR 94.9          PISTON HEAD NUT, B52M      .68           .36
 0001        UP 01   00         .00                            PART NUMBER/NSN            .000   .000   .000          0
    0010                            3-80736-3            5310006035970LE
 0029        UP 01   24        1.00                            DEGREASE                   .097   .023   .120         18
    0010 E            RWB-CV-D1  1.00 VAPOR CL (DEGR)HOOK/BASKET                          .08709        .107
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0030        UP 01   24         .95                            STRIP CAD                  .136   .031   .161   .5   24
    0010 E            ZCD-ST-S1  1.00 STRIP CAD PLATE SMALL PART                          .12630        .156
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0035        UP 01   24         .05                            STRIP RUST                 .136   .002   .008   .3    1
    0010 E            ZCD-ST-S1  1.00                          STRIP RUST                 .12630        .156
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0060        UP 01   24         .23                            SHOTPEEN SM STEEL PART/MASK .278  .015   .079         12
    0010 E            ZMA-CP-S2  1.00 MASK SMALL COMPONENT PART                           .08183        .101
    0020 E            RPL-SP-M1  1.00 SHOT PEEN SMALL/MED PART                            .16131        .200
    0030 N            ZUM-CL-02   .50 UNMASK MEDIUM SIZE CYL PART OCC 50% FOR SMALL PART  .05067        .031
    0040 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
    5        UP 01   24        1.00                            GRIT BLAST                 .046   .011   .058          8
    0010 E            RWB-CB-B1  1.00 BLAST SM PT OR BSKT V/SM PTS                        .03668        .045
    )020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0070        UP 01   24         .95                            CAD PLATE                  .102   .023   .120         18
    0010 E            ZPL-CD-S1  1.00 CADMIUM PLATE SMALL PART                            .09212        .114
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0080        UP 01   24         .95                            BAKE AFTER CAD PLATE       .090   .021   .107 38.0  16
    0010 E            ZPL-BK-S1  1.00 BAKE SM PART 4HR/24HR BAKE                          .08088        .100
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC                        .01001        .012
 0093        UP 01   24         .05                            I.V.D. ALUMINUM PLATE      .230   .003   .014  1.0    2
    0010 N                       1.00                          I.V.D. PLATE               .22000        .272
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                       .01001        .012
 0097        UP 01   24         .05                            ALODINE I.V.D. ALUM PLATE  .230   .003   .014          2
    0010 N                       1.00                          ALODINE                    .22000        .272
    0020 E            RJP-PW-R1  1.00 REM RPL PAPRWRK SIGN OFF DOC/                       .01001        .012
 9000        UP 01   24         .01                            LABOR STANDARD HISTORY     .000   .000   .000          0
    0010                            PRIOR HISTORY ON OO-ALC 494 FORM
    0020                            25FEB83 NEW OCC. STUDY UPDATE                   .36
    0021                            01AUG84 REWRITE STD W/NEW OCC FACTORS<OLD STD> .20
    0022                            05DEC84 ADD UNMASK & CHG BLAST CLEAN <OLD STD> .28
    0023                            23JUL85 NEW OCC FACTORS & REVIEW <OLD STD>    .25


'O INTERROGATE LABOR STANDARDS. INPUT

 RD NROP NR
      --X--->
.2..../890123456  ELSE PUT IN END
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MANPRC

I7S15UED. ALC. 03MA?PC.FH

2/ 3/89

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

X	PROD NO X	X	NOUN	RCC DPEH	X RCC DPEH %	CUMM % EARNED HR
1	17143A	1620001398474	B52M-AFT	1229.10	0.0400	0.0400
2	16837A	1620001099287	STRUTF4C	1093.88	0.0356	0.0756
3	17142A	1620001398473	B52M-FWD	1002.43	0.0326	0.1082
4	16836A	1620001099286	STRUTF4C	910.43	0.0296	0.1378
5	74805A	1005000566753	GUN M61A	853.12	0.0278	0.1656
6	15468A	1630004927144	KC-135 M	744.04	0.0242	0.1898
7	90101A	1630011826267	WHEEL	659.72	0.0215	0.2113
8	17565A	1620010204973	STRUT	604.95	0.0197	0.2310
9	16915A	1620009485066	TRUCK AY	583.06	0.0190	0.2500
10	74527A	1620004427877	BRACE DR	581.33	0.0189	0.2689
11	00124B	000F0004E	AIRCRAFT	576.70	0.0188	0.2877
12	69324A	1095011003892	MAU-12DA	528.71	0.0172	0.3049
13	69354A	1620010597842	KC-135 N	504.93	0.0164	0.3213
14	74524A	1620002468005	BOGIE B	482.43	0.0157	0.3370
15	69595A	1630012286043	ML WHEEL	450.00	0.0146	0.3516
16	00126B	00RF0004C	AIRCRAFT	447.80	0.0146	0.3662
17	17575A	1620010054191	C5MLGRHA	405.96	0.0132	0.3794
18	16019A	1620010248844	STRUT F4	399.97	0.0130	0.3924
19	17357A	1620007419178	BRACE	393.13	0.0128	0.4052
20	17576A	1620010054192	C5MLGLHA	373.82	0.0122	0.4174
21	25737A	1620011951141	MLGSTRUT	365.65	0.0119	0.4293
22	19844A	1620008961203	STRUT AY	363.35	0.0118	0.4411
23	62927A	1630011326400	WHL C141	353.56	0.0115	0.4526
24	74692A	1620001791425	BOGIE BM	325.97	0.0106	0.4632
25	69855A	1620006052768	B52PLATE	307.12	0.0100	0.4732
26	17478A	1620002990278	T38-NLG	305.10	0.0099	0.4831
27	17239A	1620006793440	TRUNNION	296.28	0.0096	0.4927
28	17451A	1620006518221	TRUNNION	290.52	0.0095	0.5022
29	26176A	1005008566885	M16RIFLE	282.72	0.0092	0.5114
30	17327A	1620009118301	TRUNNION	268.74	0.0087	0.5201
31	15139A	1630009089739	WHEEL 52	267.41	0.0087	0.5288
32	17354A	1620005459439	STRUT NL	256.63	0.0084	0.5372
33	15485A	1630004463778	WHL F4	244.84	0.0080	0.5452
34	74521A	1620001877445	NLG	243.02	0.0079	0.5531
35	26338A	1620011671000	M-LH-HW	231.81	0.0075	0.5606
36	17348A	1620007117771	S STRUT	230.01	0.0075	0.5681
37	17631A	1620010159859	DR-BRACE	225.58	0.0073	0.5754
38	17577A	1620010054193	C5MGLLHF	223.82	0.0073	0.5827
39	17402A	1620010627002	F15-NLG	219.85	0.0072	0.5899
40	63822A	1005008953726	M168 GUN	218.24	0.0071	0.5970
41	17347A	1620007099371	S STRUT	199.40	0.0065	0.6035
42	17578A	1620010054194	C5MLGRHF	197.27	0.0064	0.6099
43	26642A	1620012026349	STRUT A8	193.79	0.0063	0.6162
44	19937A	1620010816339	STRUT AY	187.84	0.0061	0.6223
45	M3009K	1450010618477AB		174.60	0.0057	0.6280
46	M7202K	3120012697856LE		173.25	0.0056	0.6336
47	19938A	1620010856039	A10-NLG	162.05	0.0053	0.6389
48	26183A	1630011375742	F15 WHL	161.87	0.0053	0.6442
49	M6276K	1620012352270		157.50	0.0051	0.6493
~~50~~	~~72573A~~	~~1620000271193~~	~~ACTUATOR~~	~~153.30~~	~~0.0050~~	~~0.6543~~
51	M9662K	3120P855926-03		151.76	0.0049	0.6592

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
52	26337A	1620011670999	M-RH-HW	151.45	0.0049	0.6641
53	17245A	1620006525472	BRACE AS	150.50	0.0049	0.6690
54	16214A	1620011252217	POWER UT	145.38	0.0047	0.6737
55	42626A	1620007158562	B52-RH.T	144.44	0.0047	0.6784
56	17568A	1620000071783	F5-TRUNN	142.45	0.0046	0.6830
57	26111A	1620012007131	16PISTON	134.68	0.0044	0.6874
58	17313A	1620006518222	TRUNNION	133.93	0.0044	0.6918
59	19588A	1630010585912	WHL F15M	132.36	0.0043	0.6961
60	63819A	1005010595785	M61A1	128.96	0.0042	0.7003
61	16264A	1620006706602	COLLAR	126.00	0.0041	0.7044
62	74516A	1620001791083	BRACE DR	123.74	0.0040	0.7084
63	16297A	1620010374639	CH3-NLG	123.44	0.0040	0.7124
64	15359A	1630000139129	WHL C135	118.99	0.0039	0.7163
65	15162A	1630002692622	KC135BRK	117.80	0.0038	0.7201
66	63393A	1095010617748	MB-3ARAC	114.24	0.0037	0.7238
67	69828A	1620005676803	ST VALVE	113.75	0.0037	0.7275
68	98929A	1650002193602LE	BUNGEE	112.00	0.0036	0.7311
69	M6055K	5315007575890LE		104.54	0.0034	0.7345
70	62963A	1680004051042LS	SEAT	102.33	0.0033	0.7378
71	62964A	1680004182785LS	SEAT	102.33	0.0033	0.7411
72	00129B	000F0004G	AIRCRAFT	101.50	0.0033	0.7444
73	17567A	1620010381912	KC-135 N	101.05	0.0033	0.7477
74	15866A	1620011037747	STRUT	100.81	0.0033	0.7510
75	T1302A	9999POV10A		100.00	0.0033	0.7543
76	69549A	1620001386373	LWRSIDES	98.04	0.0032	0.7575
77	T6912A	1620006133512		97.60	0.0032	0.7607
78	17474A	1620002640744	T38M-L/H	96.79	0.0032	0.7639
79	15686A	1630005969637	WHEEL N	95.76	0.0031	0.7670
80	T6254A	1620008624060		94.30	0.0031	0.7701
81	63079A	1680010520816LS	REEL AS	93.13	0.0030	0.7731
82	74652A	1620001486466	BALLSCRW	92.31	0.0030	0.7761
83	17396A	1620002671046	DAMPER	91.00	0.0030	0.7791
84	17407A	1620009921498	BOLT ASY	89.76	0.0029	0.7820
85	72877A	1620004325651	NLG	81.73	0.0027	0.7847
86	M8586K	1630005022994		81.25	0.0026	0.7873
87	16123A	1620006776681	C130BASK	81.06	0.0026	0.7899
88	13822A	1560007883941BF	RING ASS	81.00	0.0026	0.7925
89	15526A	1630002420942	WHEEL B	80.88	0.0026	0.7951
90	15988A	1620009825059	POSITNER	77.93	0.0025	0.7976 24673
91	68521A	1630010385126	WH C130M	76.20	0.0025	0.8001
92	16296A	1620004821247	CH3-MLG	71.08	0.0023	0.8024
93	13829A	1560007906873BF	RING ASS	71.00	0.0023	0.8047
94	74955A	1095009960098	RACK	70.68	0.0023	0.8070
95	72898A	1630002861879	WHEEL N	69.76	0.0023	0.8093
96	16283A	1620007856073	SHAFT	69.65	0.0023	0.8116
97	94332A	1620000222923	ACTUATOR	68.67	0.0022	0.8138
98	74506A	1620009322368	BRACE DR	68.02	0.0022	0.8160
99	72879A	1620004463776	MLG OUTR	67.75	0.0022	0.8182
~~100~~	~~62923A~~	~~1630011253957~~	~~WHL C141~~	~~66.48~~	~~0.0022~~	~~0.8204~~
101	69657A	1620010389102	STRUT LH	65.97	0.0021	0.8225

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
103	35571A	1620003353404	STOP ASY	63.27	0.0021	0.8267
104	T6295I	1620002421514		63.00	0.0021	0.8288
105	16315A	1620010710535	F16MAXLE	62.88	0.0020	0.8308
106	17418A	1620010135910	SHOCK ST	61.85	0.0020	0.8328
107	17479A	1620010185924	ACTUATOR	61.70	0.0020	0.8348
108	00109B	00RF0004C	AIRCRAFT	61.20	0.0020	0.8368
109	00119B	000F0004G	AIRCRAFT	61.20	0.0020	0.8388
110	25425A	1630011158736	WHEEL	60.52	0.0020	0.8408
111	69554A	1620005251156	LWR UNIV	60.48	0.0020	0.8428
112	83317A	1620011627542	DR BRACE	60.14	0.0020	0.8448
113	M4292K	3120010595944LE		60.00	0.0020	0.8468
114	17664A	1620010700632	STRUT	59.78	0.0019	0.8487
115	69803A	1620011680338	CH3-NLG	58.12	0.0019	0.8506
116	M7139K	3120012828006LE		56.21	0.0018	0.8524
117	69651A	1620006238911	STRUT	55.98	0.0018	0.8542
118	69833A	1620011031950	STRUT	55.48	0.0018	0.8560
119	25638A	1005010086283	HOUSING	54.72	0.0018	0.8578
120	17574A	1620003977413	CRK ASSY	54.60	0.0018	0.8596
121	15865A	1620009272601	C141LKAS	54.56	0.0018	0.8614
122	74553A	1620009746793	BRACE DR	53.70	0.0017	0.8631
123	17476A	1620002795839	T38M-R/H	53.59	0.0017	0.8648
124	M3416K	4730012107834AY		49.50	0.0016	0.8664
125	17353A	1620005459395	STRUT NL	49.17	0.0016	0.8680
126	17467A	1620006509335	TORSION	47.36	0.0015	0.8695
127	16267A	1630008521432	F4N WHL	46.93	0.0015	0.8710
128	15757A	1630009141329	WHL C130	45.60	0.0015	0.8725
129	74552A	1620009270298	PIVOT P	44.84	0.0015	0.8740
130	T5046J	1560008561386BF		44.40	0.0014	0.8754
131	15523A	1630001576723	WHL F111	44.03	0.0014	0.8768
132	61427A	6720010447789	MIRR ASY	44.00	0.0014	0.8782
133	14907A	1680001598730YQ	THROTTLE	43.26	0.0014	0.8796
134	T6850A	1620001157419		43.09	0.0014	0.8810
135	17663A	1620010668946	STRUT	42.16	0.0014	0.8824
136	15746A	1630000816687	WHL-C141	42.03	0.0014	0.8838
137	17546A	1620001405241	F5-LH-DB	41.66	0.0014	0.8852
138	16743A	1620002041208	BELLCRNK	40.82	0.0013	0.8865
139	00118B	000F0004E	AIRCRAFT	40.80	0.0013	0.8878
140	25918A	1620010141934	RHSTRUT	40.12	0.0013	0.8891
141	15828A	1630010389239	WHL F16M	39.83	0.0013	0.8904
142	17527A	1620010063237	A7-MLG	39.82	0.0013	0.8917
143	16334A	1620010710537	F16MAXLE	39.30	0.0013	0.8930
144	18076A	3040001614085LE	ROD ASSY	38.10	0.0012	0.8942
145	16266A	1630007300126	F4N WHL	37.43	0.0012	0.8954
146	15054A	1630000585242	KC135BRK	37.20	0.0012	0.8966
147	00141B	000V0010A	AIRCRAFT	36.60	0.0012	0.8978
148	14539A	1560009116602BF	STBLRF4E	36.00	0.0012	0.8990
149	17595A	1620008372427	A7-MLG	35.82	0.0012	0.9002
150	69136A	1620009272600	LINK ASY	35.52	0.0012	0.9014
151	M5514K	3120005101857LE		34.00	0.0011	0.9025
~~152~~	~~62905A~~	~~1630009658700~~	~~C130 WHL~~	~~33.78~~	~~0.0011~~	~~0.9036~~
153	72863A	1620001790438	XWIND CL	32.92	0.0011	0.9047

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
154	T4798A	1620004853752		32.55	0.0011	0.9058
155	15481A	1630004534893	WHL C141	32.26	0.0011	0.9069
156	72858A	1620003238292	CYLINDER	32.18	0.0010	0.9079
157	T1434A	9999P000V0010A		32.00	0.0010	0.9089
158	17686A	162000281062P	LINK ASY	31.75	0.0010	0.9099
159	17314A	1620003069942	S STRUT	31.57	0.0010	0.9109
160	17315A	1620003069943	S STRUT	31.57	0.0010	0.9119
161	72571A	1620009101898	ACTUATOR	30.30	0.0010	0.9129
162	72845A	1620001157413	CYLINDER	30.18	0.0010	0.9139
163	74561A	1620001357877	A7-NLG	29.17	0.0009	0.9148
164	15161A	1630008810815	C141 BRK	28.50	0.0009	0.9157
165	M6927K	1560005182799BF		27.90	0.0009	0.9166
166	17324A	1620003002261	SHOCK ST	27.42	0.0009	0.9175
167	74909A	1095001419328	RACK ASY	27.20	0.0009	0.9184
168	26109A	1620012348655	F16BRACE	26.83	0.0009	0.9193
169	19841A	1620001239478	DAMPER	26.47	0.0009	0.9202
170	17547A	1620001405242	FS-RH-DB	26.25	0.0009	0.9211
171	M7527K	5975P878960F		25.00	0.0008	0.9219
172	M4250K			24.50	0.0008	0.9227
173	96722A	1630006210657	SHIELD	24.15	0.0008	0.9235
174	15941A	6760010932628	MIRROR	24.00	0.0008	0.9243
175	29244A	6720010480672	MIRROR 4	24.00	0.0008	0.9251
176	T6674L	1440010738446JB		24.00	0.0008	0.9259
177	17687A	1620010805925	INNER CL	23.61	0.0008	0.9267
178	T7601I	1620000071783		23.52	0.0008	0.9275
179	69626A	1620005051184	STRUT AY	23.19	0.0008	0.9283
180	17757A	4730007586711LE	BOLT	23.18	0.0008	0.9291
181	72864A	1620002307141	PITCH PO	23.00	0.0007	0.9298
182	68735A	1630010830445	F15ABBRK	22.53	0.0007	0.9305
183	M1290K	1560002462632BF		22.50	0.0007	0.9312
184	19839A	1620007391746	DAMPER	22.45	0.0007	0.9319
185	74958A	1095004538407	RACK	22.32	0.0007	0.9326
186	69551A	1620003129664	LINKASSY	22.04	0.0007	0.9333
187	17662A	1620010668945	STRUT-MG	21.76	0.0007	0.9340
188	63711A	1620000254773	B52-DRAG	21.63	0.0007	0.9347
189	74518A	1620001791087	BRACE DR	21.52	0.0007	0.9354
190	93236A	1620001058930	ACTUATOR	21.24	0.0007	0.9361
191	45578A	1630011392892	WHEEL ML	21.00	0.0007	0.9368
192	24372A	1620008242889	LINK ASY	20.51	0.0007	0.9375
193	15641A	1630002769849	F4 HSG	20.43	0.0007	0.9382
194	00121B	000F0004D	AIRCRAFT	20.40	0.0007	0.9389
195	M5244K	1560ND028885QBF		20.00	0.0007	0.9396
196	M7490K	5365012790018WF		20.00	0.0007	0.9403
197	M7492K	5365012790017WF		20.00	0.0007	0.9410
198	M7493K	5365012790023WF		20.00	0.0007	0.9417
199	M7495K	5365012790022WF		20.00	0.0007	0.9424
200	M7496K			20.00	0.0007	0.9431
201	M7498K			20.00	0.0007	0.9438
~~202~~	~~M7499K~~	~~5365012797204WF~~		~~20.00~~	~~0.0007~~	~~0.9445~~
203	M7502K	5365012793475WF		20.00	0.0007	0.9452
204	M7503K			20.00	0.0007	0.9459

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN	RCC OPEH	RCC OPEH %	CUMM % EARNED HR
205	M7504K	5365012793474WF		20.00	0.0007	0.9466
206	M7871K	1450ND029644GAH		20.00	0.0007	0.9473
207	26526A	1005006743915	DRUM	19.52	0.0006	0.9479
208	T5305A	1620010888102		19.52	0.0006	0.9485
209	97709A	1620006986015	CYC	19.46	0.0006	0.9491
210	M6486K	1095004760051		18.27	0.0006	0.9497
211	M6488K	1095004760037		18.27	0.0006	0.9503
212	M6604K	1650003017883		18.00	0.0006	0.9509
213	M8168K			18.00	0.0006	0.9515
214	M5224K	1560ND028868GBF		17.80	0.0006	0.9521
215	62956A	1427011043012AB	G&C UNIT	17.52	0.0006	0.9527
216	74528A	1620004719659	D/B TRUN	17.52	0.0006	0.9533
217	26108A	1620011627518	F-16 NLG	17.48	0.0006	0.9539
218	74895A	1005009988912	FEEDER	17.36	0.0006	0.9545
219	19838A	1620001177326	DAMPER	16.95	0.0006	0.9551
220	25874A	1630011996430	F16 BRK	16.53	0.0005	0.9556
221	24373A	1620008302609	LINK/ATT	16.26	0.0005	0.9561
222	T4404N	1430ND026070GAH		16.00	0.0005	0.9566
223	62922A	1630010506139	WHL C141	15.72	0.0005	0.9571
224	15348A	1630008430965	WHLF111	15.60	0.0005	0.9576
225	60420A	1620010714803	TEN STRU	15.43	0.0005	0.9581
226	T6687A	1620007197427		15.36	0.0005	0.9586
227	97659A	1620006986014	CYLINDER	15.17	0.0005	0.9591
228	42625A	1620007158561	STRUT	15.07	0.0005	0.9596
229	72832A	1620000018416	STR ACT	14.55	0.0005	0.9601
230	68776A	1005006741425	M1 GUN	13.80	0.0004	0.9605
231	16271A	1650004558129LE	MANIFOLD	13.53	0.0004	0.9609
232	17921A	1005010446174	DRUMASSY	13.50	0.0004	0.9613
233	M5934K	1560012091468UF		13.50	0.0004	0.9617
234	68878A	1620011009806	STRUT MG	13.39	0.0004	0.9621
235	69761A	1620004427875	XWIND CL	13.16	0.0004	0.9625
236	T7546A	1620001405240		13.16	0.0004	0.9629
237	26492A	1005005287684	HANDOFF	13.02	0.0004	0.9633
238	14781A	1560008561386BF	HKPNT F4	12.71	0.0004	0.9637
239	93582A	6760004833094	MAGAZINE	12.60	0.0004	0.9641
240	15068A	1630007776698	B52 BRK	12.48	0.0004	0.9645
241	74941A	1095004767948	RACK ASY	12.40	0.0004	0.9649
242	14443A	1680007029382LB	TIMER	12.38	0.0004	0.9653
243	77261A	1620007330993	CAM	12.16	0.0004	0.9657
244	74571A	1620009317355	TORQ ARM	12.04	0.0004	0.9661
245	34129A	6720010688350	MIRROR 1	12.00	0.0004	0.9665
246	15862A	1620010710538	F16PASSY	11.85	0.0004	0.9669
247	93672A	6605009497835	OSDU	11.78	0.0004	0.9673
248	26110A	1620012005320	F16PISTO	11.50	0.0004	0.9677
249	M5566K			11.43	0.0004	0.9681
250	74575A	1620009299692	P-N 3C61	11.40	0.0004	0.9685
251	M7619K	3120P879596F		11.25	0.0004	0.9689
252	M7620K	3120P879593F		11.25	0.0004	0.9693
~~253~~	~~15677A~~	~~1620011741655~~	~~STRUT AY~~	~~11.23~~	~~0.0004~~	~~0.9697~~
254	M6710K	5330ND025812GAH		11.22	0.0004	0.9701
255	63191A	1440010841618AB	LAUNCHER	11.16	0.0004	0.9705

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	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
256	74551A	1620008670810	SHAFT AS	11.16	0.0004	0.9709
257	68736A	1440011093258JB	MRD	11.10	0.0004	0.9713
258	34507A	1630005404253	F100 BRK	10.40	0.0003	0.9716
259	69887A	1620007057261	B52-RH-T	10.29	0.0003	0.9719
260	M7505K	5365012790018WF		10.29	0.0003	0.9722
261	M7512K	5365012790023WF		10.29	0.0003	0.9725
262	M7511K	5365012790017WF		10.28	0.0003	0.9728
263	15752A	1630010627046	A10 BRK	10.26	0.0003	0.9731
264	M7522K	5365012793476WF		10.20	0.0003	0.9734
265	25917A	1620010141983	LHSTRUT	10.17	0.0003	0.9737
266	M9775K	5315004347447LE		10.10	0.0003	0.9740
267	M7519K	5365012793473WF		10.06	0.0003	0.9743
268	M7516K	5365012790021WF		10.00	0.0003	0.9746
269	M7521K	5365012793475WF		10.00	0.0003	0.9749
270	M7524K	5365012793474WF		10.00	0.0003	0.9752
271	M9195K	5306008249117		10.00	0.0003	0.9755
272	69573A	1620006238913	TORO ST	9.97	0.0003	0.9758
273	68965A	6760010447792	SPIN MOT	9.92	0.0003	0.9761
274	74851A	1005007265650	GUN	9.92	0.0003	0.9764
275	15053A	1630000528403	BRAKEASS	9.88	0.0003	0.9767
276	17964A	1630010716112	F15 NW	9.88	0.0003	0.9770
277	T7040Q	1560007886321BF		9.86	0.0003	0.9773
278	15728A	1630009376604	HOUSING	9.69	0.0003	0.9776
279	69103A	1620010972968	LH CONTR	9.66	0.0003	0.9779
280	M7565K	5365P32-41126-3		9.00	0.0003	0.9782
281	69104A	1620010976091	RH CONTR	8.74	0.0003	0.9785
282	15753A	1630010098474	WHL E3AM	8.67	0.0003	0.9788
283	M5801K	1560011990571BF		8.64	0.0003	0.9791
284	15361A	1630000542557	WHLB52	8.56	0.0003	0.9794
285	22420A	1630008329087	WHEEL MG	8.40	0.0003	0.9797
286	M9408K			8.25	0.0003	0.9800
287	M9409K	3120012146745		8.25	0.0003	0.9803
288	26578A	1620ND053797G	DRG BRAC	8.07	0.0003	0.9806
289	78048A	1620009438754	BRACE	8.07	0.0003	0.9809
290	63826A	1005000431167	FEEDUNIT	8.06	0.0003	0.9812
291	74535A	1620008699889	BRACE DR	7.96	0.0003	0.9815
292	16582A	1620010715592	F-16TARM	7.81	0.0003	0.9818
293	T6301A	1620002421519		7.50	0.0002	0.9820
294	M0124K	1560ND0242336BF		7.20	0.0002	0.9822
295	T9439A	1620009872517		7.20	0.0002	0.9824
296	69775A	5315005006801LE	ROOT PIN	7.12	0.0002	0.9826
297	34456A	1620000922837	DRG LINK	6.90	0.0002	0.9828
298	69658A	1620010389101	STRUT RH	6.81	0.0002	0.9830
299	16288A	1620009248927	YOKE	6.75	0.0002	0.9832
300	M0002K	1560P16P194-67		6.75	0.0002	0.9834
301	M0005K	1560P16P194-241		6.75	0.0002	0.9836
302	16727A	1620011249137	F-16TARM	6.72	0.0002	0.9838
303	15327A	1630008254794	BRKC130	6.65	0.0002	0.9840
~~304~~	~~74568A~~	~~1630004100858~~	~~A7 BRK~~	~~6.65~~	~~0.0002~~	~~0.9842~~
305	14991A	3040001646783LE	LINK CON	6.60	0.0002	0.9844
306	63153A	1005010429820	GUNGUUSP	6.20	0.0002	0.9846

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	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
307	19314A	1620010710968	F16COLAR	6.10	0.0002	0.9848
308	T1067H	1680011089660		6.00	0.0002	0.9850
309	T6779I	1620000563339		6.00	0.0002	0.9852
310	62486A	1095004767947	RACK MAU	5.94	0.0002	0.9854
311	M7638K			5.88	0.0002	0.9856
312	16317A	1450011005926AH	ELV W C	5.76	0.0002	0.9858
313	87051H	1005010086283	HOUSING	5.76	0.0002	0.9860
314	M6114K	1430ND027897GBF		5.70	0.0002	0.9862
315	69088A	1005010502735	EXITUNIT	5.58	0.0002	0.9864
316	69794A	1630011414695	F15 WHL	5.32	0.0002	0.9866
317	17517A	1620003486485	TUBE	5.22	0.0002	0.9868
318	15295A	1630000827955	F111 BRK	5.13	0.0002	0.9870
319	16298A	1630010659469	F15CDHSG	5.13	0.0002	0.9872
320	57174A	1440001727419AH	ROTARY I	5.00	0.0002	0.9874
321	74857A	1005007755578	ADAPTER	4.96	0.0002	0.9876
322	15387A	1630005557523	T38 BRK	4.94	0.0002	0.9878
323	M8840K	1430000133077AH		4.86	0.0002	0.9880
324	62902A	1620000313537	CYLINDER	4.85	0.0002	0.9882
325	42078A	1005008953722	HOUSING	4.80	0.0002	0.9884
326	94829A	1620004023387	ACTUATOR	4.80	0.0002	0.9886
327	T9564A	1620008840372		4.78	0.0002	0.9888
328	19847A	1630010597069	F15CDBRK	4.74	0.0002	0.9890
329	15834A	1620010710536	F-16 PIN	4.71	0.0002	0.9892
330	26597A	1620012548600	TORQUEAM	4.68	0.0002	0.9894
331	15651A	1630005582584	WHEEL AS	4.56	0.0001	0.9895
332	00167C	000F0016C	AIRCRAFT	4.50	0.0001	0.9896
333	M7171K	1420ND030175GAH		4.50	0.0001	0.9897
334	M7172K	1420ND030176GAH		4.50	0.0001	0.9898
335	M7173K	1420ND030177GAH		4.50	0.0001	0.9899
336	M7174K	1420ND030178GAH		4.50	0.0001	0.9900
337	T7163A	1620001753939		4.50	0.0001	0.9901
338	M6275K	3840003556251BF		4.48	0.0001	0.9902
339	M3893K	1560P733002-003		4.44	0.0001	0.9903
340	17494A	1620003084145	F15N-OUT	4.43	0.0001	0.9904
341	23284A	1005005891271	M-14 RIF	4.34	0.0001	0.9905
342	74802A	1005000431167	ENTRANCE	4.34	0.0001	0.9906
343	74817A	1005002213325	FEEDER A	4.34	0.0001	0.9907
344	52448A	6720010678701	MIRR SPN	4.00	0.0001	0.9908
345	T1209A	000F0004E		4.00	0.0001	0.9909
346	T7043A	1620005343898		3.76	0.0001	0.9910
347	T7263Q			3.75	0.0001	0.9911
348	69098A	1620003654001	BALLSCRU	3.72	0.0001	0.9912
349	92679A	6605009159319	RECON AD	3.72	0.0001	0.9913
350	15248A	1630009000745	WHL F100	3.60	0.0001	0.9914
351	96274A	1650001685965BF	TURBINE	3.52	0.0001	0.9915
352	69385A	1620004107094	ROD CYL	3.38	0.0001	0.9916
353	M9357K			3.30	0.0001	0.9917
354	25369A	1620010569656	F-16 CYL	3.10	0.0001	0.9918
355	M6265K	5306ND026872GAH		3.04	0.0001	0.9919
~~356~~	~~M7001K~~	~~5340008703741AH~~		~~3.00~~	~~0.0001~~	~~0.9920~~
357	T1065H	1680011089660		3.00	0.0001	0.9921

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	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
358	T1066H	1680011089660		3.00	0.0001	0.9922
359	T5943Q	6760P1264-898		3.00	0.0001	0.9923
360	19557A	1680010530071LS	INE REEL	2.97	0.0001	0.9924
361	M3895K	1560P540109-017		2.96	0.0001	0.9925
362	M3896K	1560P540109-019		2.96	0.0001	0.9926
363	59596A	1450001142786AH	YOKE AY	2.88	0.0001	0.9927
364	69548A	1620007659187	CENT.CYL	2.87	0.0001	0.9928
365	69555A	1620006142351	UPUNIVLH	2.80	0.0001	0.9929
366	M5356K			2.70	0.0001	0.9930
367	26579A	1620ND0520836	DRG BRAC	2.69	0.0001	0.9931
368	69288A	1620009438753	BRACE	2.69	0.0001	0.9932
369	15438A	1630005802857	T-29 BRK	2.66	0.0001	0.9933
370	16623A	1620011146869	C141T.A.	2.64	0.0001	0.9934
371	15302A	1630009414191	WHLF111	2.61	0.0001	0.9935
372	M5789K	5310ND0296100AH		2.52	0.0001	0.9936
373	T6944J	1620007729657		2.52	0.0001	0.9937
374	00162C	000F0016A	AIRCRAFT	2.50	0.0001	0.9938
375	26679A	1325000099597	MXU AFG	2.50	0.0001	0.9939
376	M4969K	1560011136448BF		2.50	0.0001	0.9940
377	15819A	1095009118407	BREECH	2.48	0.0001	0.9941
378	74887A	1005009365371	ADAPTER	2.48	0.0001	0.9942
379	18182A	1620009224173	TUBE	2.34	0.0001	0.9943
380	19266A	1630010098475	E3A BRK	2.28	0.0001	0.9944
381	M4841K	1450000056722AH		2.25	0.0001	0.9945
382	M9354K	1620010594518		2.25	0.0001	0.9946
383	M6769K	1560001377637BF		2.16	0.0001	0.9947
384	69625A	1620004100874	CYLINDER	2.04	0.0001	0.9948
385	00169C	000F0016D	AIRCRAFT	2.00	0.0001	0.9949
386	16228A	1325004918006	AIR FOIL	2.00	0.0001	0.9950
387	M3928K	1560P16P194-95		2.00	0.0001	0.9951
388	M6118K	1430ND0285680AH		2.00	0.0001	0.9952
389	M9755K	1560ND029964GUF		2.00	0.0001	0.9953
390	M9761K	1560ND030498GUF		2.00	0.0001	0.9954
391	T1064H	1680011089660		2.00	0.0001	0.9955
392	T4047J			2.00	0.0001	0.9956
393	T4521Q	1620001877445		2.00	0.0001	0.9957
394	74709A	1630004649167	CS HSG	1.90	0.0001	0.9958
395	18395A	1005004197188	BODY ROT	1.86	0.0001	0.9959
396	19899A	1005005703715	COVER	1.86	0.0001	0.9960
397	69577A	1620009763391	BRACE AY	1.81	0.0001	0.9961
398	69578A	1620011431155	STRUT AY	1.78	0.0001	0.9962
399	74525A	5315002952512LE	ROOT PIN	1.78	0.0001	0.9963
400	16354A	142701104301 1AB	CONTROL	1.75	0.0001	0.9964
401	M6576K	7105P857712F		1.75	0.0001	0.9965
402	15698A	1630010414570	C5A BRKE	1.71	0.0001	0.9966
403	69566A	1620009535572	VALVE	1.70	0.0001	0.9967
404	M9921K	1560010058769BF		1.68	0.0001	0.9968
405	M4170K	1560P877530F		1.60	0.0001	0.9969
~~406~~	~~M7680K~~			~~1.60~~	~~0.0001~~	~~0.9970~~
407	M7682K			1.60	0.0001	0.9971
408	74565A	1630000752003	A7D WHL	1.52	0.0000	0.9971

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	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
409	69558A	1620006142352	UPUNIVRL	1.50	0.0000	0.9971
410	M3907K	1560P878263F		1.50	0.0000	0.9971
411	M6239K	5310012766189		1.50	0.0000	0.9971
412	T4162N	000F0016A		1.50	0.0000	0.9971
413	19908A	1005010525278	TURNARND	1.48	0.0000	0.9971
414	M3894K	1560P733003-003		1.48	0.0000	0.9971
415	69707A	1620003051849	BRACE	1.42	0.0000	0.9971
416	M7169K	1420ND030072GAH		1.35	0.0000	0.9971
417	M7170K	1420ND030174GAH		1.35	0.0000	0.9971
418	M7175K	1420ND030179GAH		1.35	0.0000	0.9971
419	M7176K	1420ND030180GAH		1.35	0.0000	0.9971
420	M9564K	5340ND029661GAH		1.35	0.0000	0.9971
421	M9568K	5340ND029665GAH		1.35	0.0000	0.9971
422	75223A	1427010158956AB	G/C UNIT	1.32	0.0000	0.9971
423	M3903K	1560P210050-3		1.32	0.0000	0.9971
424	M5389K	1560001371370BF		1.32	0.0000	0.9971
425	M3933K	1560P16P194-241		1.25	0.0000	0.9971
426	18365A	1560009834324BF	WING SEC	1.24	0.0000	0.9971
427	18863A	1560001706671BF	C WING	1.24	0.0000	0.9971
428	T5039I	1620001947597		1.20	0.0000	0.9971
429	15644A	1630001238806	F15 HSG	1.14	0.0000	0.9971
430	T8586A	1630005090317		1.14	0.0000	0.9971
431	M7509K			1.08	0.0000	0.9971
432	69556A	1620005918508	ACT BEAM	1.06	0.0000	0.9971
433	T9743I	1620010403581		1.03	0.0000	0.9971
434	68894A	1620003051726	F15N-ARM	1.02	0.0000	0.9971
435	M4010K			1.02	0.0000	0.9971
436	00166C	000F0016B	AIRCRAFT	1.00	0.0000	0.9971
437	M0001K	1560P32-80153-3		1.00	0.0000	0.9971
438	M3906K	1560P877246F		1.00	0.0000	0.9971
439	M4161K			1.00	0.0000	0.9971
440	M4908K			1.00	0.0000	0.9971
441	M4925K	3120ND029912GLE		1.00	0.0000	0.9971
442	M6246K	1560P16S1301-11		1.00	0.0000	0.9971
443	M7569K			1.00	0.0000	0.9971
444	M7826K	1560K0165698BWF		1.00	0.0000	0.9971
445	T5652A	1630007947437		1.00	0.0000	0.9971
446	T6111A	1620011607167		1.00	0.0000	0.9971
447	M5974K	5845L879861F		0.96	0.0000	0.9971
448	69557A	1620006587980	BRAKEROD	0.93	0.0000	0.9971
449	37055A	1005000180845	FEED ASY	0.90	0.0000	0.9971
450	M4383K	1560010495906BF		0.90	0.0000	0.9971
451	M5386K			0.84	0.0000	0.9971
452	M6985K			0.84	0.0000	0.9971
453	15576A	1630001473854	F5E BRK	0.76	0.0000	0.9971
454	16404A	1630010140656LC	C130H WH	0.76	0.0000	0.9971
455	19973A	1630010109337	E3A WHL	0.76	0.0000	0.9971
456	M0031K	1560P111656F		0.75	0.0000	0.9971
457	M2031K	1630ND026148G		0.75	0.0000	0.9971
458	M3925K	1560P32-60041-2		0.75	0.0000	0.9971
459	M3927K	1560P105870F		0.75	0.0000	0.9971

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN	RCC DPEH	RCC DPEH %	CUMM % EARNED HR
460	M3930K	1560P109289F		0.75	0.0000	0.9971
461	M7819K	1560K0165698BWF		0.75	0.0000	0.9971
462	T7692A	1560011578040WF		0.75	0.0000	0.9971
463	19896A	1005005585216	ENTRUNIT	0.74	0.0000	0.9971
464	M7889K	4710ND029559GAH		0.72	0.0000	0.9971
465	M4165K			0.68	0.0000	0.9971
466	26290A	1620001058933	T38DRAG	0.67	0.0000	0.9971
467	M4830K	3120001313526		0.66	0.0000	0.9971
468	M5329K	471001004829BF		0.66	0.0000	0.9971
469	M5274K	1560ND025589GBF		0.65	0.0000	0.9971
470	M9194K	5306002972568FG		0.65	0.0000	0.9971
471	M3932K	1560P16P194-67		0.64	0.0000	0.9971
472	M6797K			0.64	0.0000	0.9971
473	19876A	1005010280626	TRANSFER	0.63	0.0000	0.9971
474	M4176K	1560P880500F		0.63	0.0000	0.9971
475	26357A	1005003441550	ROTORBDY	0.62	0.0000	0.9971
476	62228A	6760010414689	MAGAZINE	0.62	0.0000	0.9971
477	90400A	1620006099886	LINK	0.61	0.0000	0.9971
478	19959A	1620009195750	DAMPER	0.60	0.0000	0.9971
479	M0030K	1560P53-11065-3		0.60	0.0000	0.9971
480	M3923K	1560P112810F		0.60	0.0000	0.9971
481	M3946K	5340P109832F		0.60	0.0000	0.9971
482	M9096K	1430ND023219GBF		0.60	0.0000	0.9971
483	15583A	1630008329088	FB111BRK	0.57	0.0000	0.9971
484	T7863I	1630011894176		0.57	0.0000	0.9971
485	19681A	1620009383574	S-P UNIT	0.56	0.0000	0.9971
486	M9119K	156001240000BF		0.56	0.0000	0.9971
487	M9693K			0.56	0.0000	0.9971
488	M3910K	4720P113565F		0.54	0.0000	0.9971
489	M3922K	1560P112812F		0.54	0.0000	0.9971
490	M5937K	4710005700522		0.54	0.0000	0.9971
491	M5972K			0.54	0.0000	0.9971
492	M8501K	312000367968BF		0.54	0.0000	0.9971
493	M0033K	1560P106647F		0.52	0.0000	0.9971
494	17605A	1620010451024	CYLINDER	0.50	0.0000	0.9971
495	56976A	1430009215077AH	03PRINTR	0.50	0.0000	0.9971
496	M4190K	1560P880769F		0.50	0.0000	0.9971
497	M6526K	156000120171IBF		0.50	0.0000	0.9971
498	M9707K	4710001499148		0.50	0.0000	0.9971
499	M6588K	4710010246631		0.49	0.0000	0.9971
500	M6590K	4710010246631		0.49	0.0000	0.9971
501	M4523K	156001193081 7BF		0.48	0.0000	0.9971
502	M5799K			0.48	0.0000	0.9971
503	M5996K	4710010501027BF		0.48	0.0000	0.9971
504	M6115K	1430ND030076GBF		0.48	0.0000	0.9971
505	M6906K	473000689429BF		0.48	0.0000	0.9971
506	M3924K			0.45	0.0000	0.9971
507	M3931K	1560P16P194-67		0.45	0.0000	0.9971
~~508~~	~~M4813K~~	~~4710008373121BF~~		~~0.45~~	~~0.0000~~	~~0.9971~~
509	M5599K	5315004144936BF		0.44	0.0000	0.9971
510	M6580K			0.44	0.0000	0.9971

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN	RCC OPEH	RCC OPEH %	CUMM % EARNED HR
511	M6832K	4710010984700BF		0.44	0.0000	0.9971
512	M6925K	4710002324142BF		0.44	0.0000	0.9971
513	M7875K	1450ND059997GAH		0.42	0.0000	0.9971
514	M9697K	4710010500188BF		0.42	0.0000	0.9971
515	69321A	1620002695025	IP MECUM	0.40	0.0000	0.9971
516	M4322K	4710001141686		0.40	0.0000	0.9971
517	M6537K	5340005273213BF		0.40	0.0000	0.9971
518	M6564K	1560010948843BF		0.40	0.0000	0.9971
519	M6774K	1560ND026767GBF		0.40	0.0000	0.9971
520	M6807K			0.40	0.0000	0.9971
521	M9700K	4710010500188BF		0.40	0.0000	0.9971
522	M4325K	4710001141686		0.39	0.0000	0.9971
523	M4774K			0.39	0.0000	0.9971
524	M4809K	4710010962886BF		0.39	0.0000	0.9971
525	M6398K	6615ND030416GWF		0.39	0.0000	0.9971
526	M6618K	4710004144105BF		0.39	0.0000	0.9971
527	M7338K	4710002383036BF		0.39	0.0000	0.9971
528	M7891K	4710ND030323GBF		0.39	0.0000	0.9971
529	M9695K	4710010500188BF		0.39	0.0000	0.9971
530	M9696K	4710010500188BF		0.39	0.0000	0.9971
531	15575A	1630001398476	WHEEL AS	0.38	0.0000	0.9971
532	15822A	1630010555056	WHL FSM	0.38	0.0000	0.9971
533	M5844K	1560011029047BF		0.38	0.0000	0.9971
534	M4632K	4710001520831BF		0.35	0.0000	0.9971
535	M7015K	4710004144993BF		0.35	0.0000	0.9971
536	M7426K	1560003903918BF		0.35	0.0000	0.9971
537	M9880K	4710001538109		0.35	0.0000	0.9971
538	M4240K	1560P371437-3		0.32	0.0000	0.9971
539	M6777K	1560005947776BF		0.32	0.0000	0.9971
540	M7091K	3040ND029844GAH		0.32	0.0000	0.9971
541	M7484K	4730ND030191GAH		0.32	0.0000	0.9971
542	M7923K	1560ND029692GBF		0.32	0.0000	0.9971
543	M9374K	1560003421873BF		0.32	0.0000	0.9971
544	M9575K			0.32	0.0000	0.9971
545	M9744K			0.32	0.0000	0.9971
546	M9771K	1560ND030603GBF		0.32	0.0000	0.9971
547	M9773K	1560ND030468GWF		0.32	0.0000	0.9971
548	M9896K	4710001589138		0.32	0.0000	0.9971
549	M9898K	4710001538109		0.32	0.0000	0.9971
550	69901A	1620011853806	INSERT	0.31	0.0000	0.9971
551	M6487K	5340ND027414GAH		0.31	0.0000	0.9971
552	16504A	6760010965035	MAGAZINE	0.30	0.0000	0.9971
553	M5275K	1560ND027702GBF		0.30	0.0000	0.9971
554	M6021K	4710004213458		0.30	0.0000	0.9971
555	M6584K	4710001241476		0.30	0.0000	0.9971
556	M6607K	4710004144991BF		0.30	0.0000	0.9971
557	M6606K	4710004144991BF		0.30	0.0000	0.9971
558	M6852K	1560010607944BF		0.30	0.0000	0.9971
559	M7002K	1560006130785BF		0.30	0.0000	0.9971
560	M7014K	4710002384132BF		0.30	0.0000	0.9971
561	M7897K	4710ND030626GBF		0.30	0.0000	0.9971

RCC EARNED HOURS FOR MNPRC...OCT 88 THRU JAN 89

	PROD NO.		NOUN		RCC DPEH	RCC DPEH %	CUMM % EARNED HR
562	M9120K	1560012400000BF			0.30	0.0000	0.9971
563	M9580K	5340ND030020GAH			0.30	0.0000	0.9971
564	M9881K	4710001538663			0.30	0.0000	0.9971
565	M9895K	4710001538663			0.30	0.0000	0.9971
566	M9897K	47100108810788F			0.30	0.0000	0.9971
567	T5578A	1630011392892			0.30	0.0000	0.9971
568	M3921K	1560P16B6530-97			0.28	0.0000	0.9971
569	M4215K	1560P874634F			0.28	0.0000	0.9971
570	M5810K	4710004144985			0.28	0.0000	0.9971
571	M6594K	4710001241476			0.28	0.0000	0.9971
572	M6622K	471000491927BBF			0.28	0.0000	0.9971
573	M6795K	4710001241880			0.28	0.0000	0.9971
574	M7844K	1560P105849F			0.28	0.0000	0.9971
575	M7899K	1560P106134F			0.28	0.0000	0.9971
576	M9882K	471001088276BBF			0.28	0.0000	0.9971
577	15222A	1630009271825	F4	HSC	0.27	0.0000	0.9971
578	M4179K	1560P879536F			0.25	0.0000	0.9971
579	M4940K	1560P16B6307-39			0.25	0.0000	0.9971
580	M4963K				0.25	0.0000	0.9971
581	M4965K	1560P16B6307-40			0.25	0.0000	0.9971
582	M5319K	156001115608BBF			0.25	0.0000	0.9971
583	M5633K	1560P16B6530-61			0.25	0.0000	0.9971
584	M6762K	1450ND027212GAH			0.25	0.0000	0.9971
585	M7523K	1560P16B6530-19			0.25	0.0000	0.9971
586	M7802K	168001069358BBF			0.25	0.0000	0.9971
587	M9574K				0.25	0.0000	0.9971
588	M4167K	1560P880497F			0.24	0.0000	0.9971
589	M4180K	1560P880502F			0.24	0.0000	0.9971
590	M4423K	4710001085546			0.24	0.0000	0.9971
591	M4522K	156001193881BBF			0.24	0.0000	0.9971
592	M4635K	471000152087BBF			0.24	0.0000	0.9971
593	M4777K	471000237297BBF			0.24	0.0000	0.9971
594	M5030K				0.24	0.0000	0.9971
595	M5932K	4710005700522			0.24	0.0000	0.9971
596	M5933K	4710005700522			0.24	0.0000	0.9971
597	M5935K	4710005700522			0.24	0.0000	0.9971
598	M5936K	4710005700522			0.24	0.0000	0.9971
599	M5980K	471000232420BBF			0.24	0.0000	0.9971
600	M5989K	4710002324201			0.24	0.0000	0.9971
601	M5991K	471000232420BBF			0.24	0.0000	0.9971
602	M5992K	4710002324201			0.24	0.0000	0.9971
603	M6019K	4710004213482			0.24	0.0000	0.9971
604	M6105K				0.24	0.0000	0.9971
605	M6139K	1440ND025665GAH			0.24	0.0000	0.9971
606	M6279K	156000431966BBF			0.24	0.0000	0.9971
607	M6280K	156000431966BBF			0.24	0.0000	0.9971
608	M6913K	4710002314368			0.24	0.0000	0.9971
609	M6916K	471000232411 9BF			0.24	0.0000	0.9971
~~610~~	~~M6963K~~	~~156000613079BBF~~			~~0.24~~	~~0.0000~~	~~0.9971~~
611	M7016K	4710004975205			0.24	0.0000	0.9971
612	M7894K	4710ND030625GBF			0.24	0.0000	0.9971

THE PROFILE SHEETS ARE IN THE FOLLOWING BOOKS

MANPGW	BRAKES
MAN PGP	WHEELS
MAN PWW	MAIN LANDING GEAR EXCEPT C5
MANPWW	NOSE LANDING GEAR EXECPT C5
MAN PRA	C5 MAIN LANDING GEAR
MANPRA	C5 BOGIE BEAM.
MANPRA	NOSE LANDING GEAR.

POTENTIAL IMPROVEMENTS

FOCUS STUDIES

TITLE: A potential process improvement opportunity (PIO) exists to (See Note) at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Many parts are masked with either or both vinyl-plastic tapes or with a hot melt plastic to prevent plating of non-essential areas or as defined per Drawing specifications/notes during chromium plating. Due to these masking operations, flow time and touch labor man hours are significantly affected.

TO-BE: By pumping the chrome plating solution through an internal bore of a part and/or the use of well-designed conforming anodes and plastic masking fixtures, the use of maskants may be significantly reduced or eliminated.

POTENTIAL IMPROVEMENTS: A significant reduction in labor to apply the rather expensive masking materials, most of which are used only once and then discarded, plus the trimming operations associated with each maskant may be realized.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined.

Note: Study the potential of developing plating equipment to eliminate masking and increase plating efficiency.

FOCUS STUDIES

TITLE: A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: The proper cleaning, activation and the chromium or nickel plating of the 300M alloy steels (used for many landing gear parts) are not being performed causing lack of proper adhesion and also pitting of the chromium deposits.

TO-BE: Proper cleaning and activation of the 300M alloy steel surfaces would virtually eliminate the high reject rate attributable to insufficient adhesion. In conjunction with improved plating procedures, the occurrence of chrome pitting could also be greatly reduced.

POTENTIAL IMPROVEMENTS:

Virtual elimination of rejects due to insufficient adhesion plus a significant reduction in chrome pitting.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined.

Note #1 - Study and develop the best plating procedure for 300M alloy steels

QUICK FIX OPPORTUNITY

TITLE: A potential process improvement opportunity (PIO) exists to (See Note) at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: The antimonial lead anodes currently used are being stored primarily in the water rinse tanks or in the chrome plating solutions without current. They develop a passive, electrically-insulating film of lead chromate, lead sulfate and lead oxide which is difficult to remove or be activated to serve as an electrode.

TO-BE: Store all anodes in air and activate the anodes (once placed in a chrome plating solution) by plating a scrap piece of steel approximately the same length as the production parts to be plated.

POTENTIAL IMPROVEMENTS: Part of the reason insufficient chrome thicknesses are obtained is due to passive or non-activated anodes

IMPLEMENTATION COST:
To be determined.

SCHEDULE:
To be determined

Note: Eliminate rework due to insufficient chrome thickness caused by lack of proper care of anodes

QUICK FIX OPPORTUNITY

TITLE: A potential process improvement opportunity (PIO) exists to decrease costs - (See Note) at RCC MANPRC at DO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: The proper positioning of conforming anodes, used to direct the deposition of chromium to the specific areas of parts to be plated, is presently haphazard in many observed instances. This results in non-uniform deposits, particularly on cylindrical parts, and requires additional expensive grinding operations.

TO-BE: Design each conforming anode for positive placement on the part to be plated using plastic (CPVC) shields on both sides of the conforming anode relative to the area to be plated to position and/or center the anode. Cylindrical parts are very subjective to this improvement in the event that non-uniform deposits result and causing grinding problems.

POTENTIAL IMPROVEMENTS: More uniformly-thick deposits of chromium will result by the use of shields to position the conforming anodes.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined.

Note- Uniform Plating Deposits with Shields

QUICK FIX OPPORTUNITY

TITLE: A potential process improvement opportunity (PIO) exists to increase parts salvaging at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Some parts, such as trunnion pins, are not repaired due to replacement cost being less than repair cost. They are scrapped-out but not destroyed. They are saved until emergency situation arises that makes their repair necessary.

TO-BE: Accumulate these parts and send a large volume to qualified vendor who will replate & grind in an economical manner depending upon size of batch.

POTENTIAL IMPROVEMENTS: Realize savings in cost of new purchase less cost of having repairs by Vendor.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (P10) exists to use of Hull Cells at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: No Hull Cell testing equipment is currently used by the operators to determine the most usable current density and also the degree of contamination.

TO-BE: Provide Hanging Hull Cells to the operators and train them how to use the Cells and to interpret the results.

POTENTIAL IMPROVEMENTS: The use of Hanging Hull Cells will offer immediate visual results to the operators as to burning, plating efficiency, ductility, covering/throwing power and degree of contamination.

IMPLEMENTATION COST:

To be determined

SCHEDULE:

To be determined.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to improve racks & fixtures at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Many parts, particularly those to be chrome plated, do not have proper fixturing to provide sufficient electrical contact area and thereby reduce the amount of heat generated. Masking materials are sometimes deteriorated due to the heat.

TO-BE: Establish a minimum electrical contact area of 1 sq. inch for each 1000 amps. Also, the contact area on both the parts to be plated and the copper rack fixtures should be clean of all contamination and oxidation before making contact.

POTENTIAL IMPROVEMENTS: Proper racks and fixtures with sufficient electrical contact area would result in less electrical power consumed and masking materials will better withstand the plating operations without deterioration.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPRC at 00- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Air-agitation is currently used on cyanide-type plating solutions (cadmium, copper and silver). This causes an excessive build-up of carbonates in the solutions.

TO-BE: Incorporate mechanical mixers or pumps to provide agitation of the cyanide-type solutions.

POTENTIAL IMPROVEMENTS: Reduce potential for rough and un-even deposits plus increase the efficiency of the solution (reduction in plating time) to obtain the desired thickness of deposit.

IMPLEMENTATION COST:
To be determined.

SCHEDULE:
To be determined.

Note #1- Extend life of cyanide-type chemical solutions

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Most training of new operators or operators assigned to new responsibilities are being trained by more experienced operators. In addition, certain operators are permitted to attend off-site seminars which do not always address their problems.

TO-BE: contract for training consultants who would conduct on-site classes and using equipment and processes currently used by the RCC.

POTENTIAL IMPROVEMENTS: The training would result in very practical, first-hand knowledge of the requirements of the RCC and be less hypothetical and generalized.

IMPLEMENTATION COST:
To be determined.

SCHEDULE:
To be determined.

Note #1 - Provide On-Site training by outside resources.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to (See Note #1) at RCC MANPRC at OO - ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: The responsibility of the repair of defects, such as the pitting and loss of sufficient bondings of chrome deposits are shared by both MANPRC and MANPRB with resultant confusion and excessive grinding operations when chemical stripping of the deposits would be more economical.

TO-BE: Establish a procedure whereby certain experienced operators from each RCC would meet periodically and determine the proper disposition of each part exhibiting the noted defects.

POTENTIAL IMPROVEMENTS: Reduce the labor touch-time and through-put time currently expended on grinding of defective chrome deposits. Deposits exhibiting poor bonding should be chemically stripped. Grinding rarely alleviates this problem. Pitted deposits are sometimes ground where chemical removal stripping would be more economical.

IMPLEMENTATION COST:

To be determined.

SCHEDULE:

To be determined

Note: #1 - Improve rework accountability.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to Improve record keeping at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Current record-keeping of rejects at MANPRC is far-superior to all other ALC plating shops but is not yet sufficiently accurate to pin-point plating problems.

TO-BE: Include the quantity (as well as areas of parts) being plated each day, record reject rate per process and per plating tank, reason for the reject (per established codes), chemical/tank discards and daily chemical consumption.

POTENTIAL IMPROVEMENTS: Improve the ability of the process engineer to pin-point causes of rejects and to ascertain the proper corrective actions.

IMPLEMENTATION COST:
To be Determined

SCHEDULE:

To be Determined.

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (PIO) exists to Conform to OSHA Reg. at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: None of the approximately 110 tanks, most of which contain hazardous (corrosive, oxidizing or toxic) chemicals have any labeling as to their contents per OSHA Hazard Communication Standard - 29 CFR 1910.1200.

TO-BE: Determine the proper labeling for each hazardous chemical tank, obtain suitable labels and affix them in a prominent position on each specific tank.

POTENTIAL IMPROVEMENTS: Afford proper communication to all personnel as to the hazards associated with each of the hazardous chemicals for safety considerations.

IMPLEMENTATION COST:
To be Determined.

SCHEDULE:
To be Determined

OTHER OBSERVATIONS

TITLE: A potential process improvement opportunity (P10) exists to (See Note #1) at RCC MANPRC at OO- ALC.

POINT(S) OF CONTACT:

AS-IS CONDITION: Parts leaving the chrome plating solutions are allowed to drip excess solution back into the tank. The part is then transferred to a nearby cold water rinse tank followed by a hot water rinse tank to facilitate drying. No effort is made to conserve water or to eliminate the discharge of hazardous chemicals.

TO-BE: Install cascade-type rinse tanks with back-flow provisions. The rinse waters contaminated with chrome salts may be re-used to replenish water lost by evaporation in the chrome tanks. By installing an evaporator, the heavily-contaminated rinse water can be treated to remove all chromium salts which may be used to replenish the chrome tanks.

POTENTIAL IMPROVEMENTS:

Achieve zero discharge of the hazardous chromium salts (which are also rated as carcinogens) from the waste stream and in addition, reduce the consumption of water in the RCC.

IMPLEMENTATION COST:

To be determined

SCHEDULE:

To be determined.

Note #1 - Improve the discharge of hazardous chemical wastes to the environment and to achieve zero discharge of a known carcinogen.

Section F—Miscellaneous

4-10. Depot Maintenance Personnel Turnover. The annual rate of turnover of personnel performing depot maintenance. This rate is based on the average number of civilian personnel assigned to AFLC depot maintenance functions during calendar year 1985 and the total depot maintenance personnel losses experienced during that year. The source of the data is the Advanced Personnel Data System-Civilian (APDS-C), E300. The OPR is HQ AFLC/DPCC.

1985 Depot Maintenance Personnel Turnover Rate

$$\frac{\text{Losses}}{\text{Assigned}} \quad \frac{2,449}{40,109} = .0611$$

4-11. AF Maintenance Personnel Turnover. The annual rate of turnover of enlisted personnel performing Air Force base level maintenance. This rate is based upon the total number of enlisted personnel assigned to aircraft maintenance Air Force specialty codes at the end of FY85 and the total number of losses experienced during that year. The source of the data is the Retention Statistic Report prescribed by AFM 30-130, Vol 1 and the Airman Force Characteristics P769 Report Prescribed by AFR 30-3 and AFR 700-4, Vol 1 and Vol 2. The OPRs are HQ AFMPC/DPMATE and HQ AFMPC/DPMYA

FY85 AF Maintenance Personnel Turnover Rate

$$\frac{\text{Losses}}{\text{Assigned}} \quad \frac{18,923}{147,567} = .1282$$

4-12. Monthly Assigned Hours. The number of hours per month a military or civilian employee is assigned for duty. Monthly assigned hours is based on a 5-day 40-hour work week. This factor equals calendar days per month less holiday and relief days (Saturday, Sunday, or compensatory weekday for weekend workday) times hours per day. The standard Air force monthly assigned hours used in allocating manpower is 167.929 hours. The source of the data is AFR 26-1. The OPR is HQ USAF/PRM. The prescribing directive is AFR 26-1 (Vol III).

4-13. Annual Available Hours. The number of hours per year a military or civilian employee is available for primary duty. Annual available hours is equal to monthly assigned hours less total nonavailable hours (leave, PCS related absences, medical leave, organizational duties, education and training, social actions, miscellaneous, overseas peculiar activities and special absenses) times 12 months. The standard annual available hours for military and civilian personnel are presented. The source of the data is AFR 26-1. The OPR is HQ USAF/MPM. The prescribing directive is AFR 26-1 (Vol III).

Calendar days	30.4375
Less:	
Holiday	0.75
Relief Days	8.6964
Assigned Days	20.9911
Times hours per day	8.0
No. Assigned hours	167.929

	Military		Civilian	
	CONUS	OS	CONUS	OS
Monthly Assigned Hours	167.929	167.929	167.929	167.929
Less Total Nonavailable	22.730	24.464	22.65	20.76
Monthly Hours Available	145.2	143.5	145.3	147.2
Times Number of Months	12.0	12.0	12.0	[illegible]
Annual Hours Available	1742.4	1722.0	1743.6 1744	[illegible]

WAGE FOR OVER TIME

DIRECT \$18.65
INDIRECT 10.06
OVERHEAD 3.27
TOTAL 31.98

BASE SALARY - WITH NO BENEFITS. \$12.44
STANDARD HOURS WORK PER 1 MAN 1744 HRS
OVERTIME IS 7½% OF THE TIME
(1744 HRS)(7.5%) = 130.8 HRS. overtime / MAN
OVER TIME PAY = BASE PAY (12.44)(1.5) = \$18.66 FOR OT.

PAY FOR.
A. STANDARD HRS. = $(1744\ \text{HR})\left(\frac{\$31.98}{\text{HR}}\right)$ = 55,773.12 MAN/YEAR

B OVERTIME HRS. $(130.8\ \text{HRS})\left(\frac{\$18.66}{\text{HR}}\right)$ = 2440.73 OT PAY

Total Pay with overTime ONE MAN = 58213.85

4/3/27

ENGINEERING NOTES

NORMAN FLETCHER
777-0899
OO-ALC

PLATING SHOP
MANPRC

GENERAL INFORMATION

MANPRC IS A Resource Control Center at OO-ALC. Its Located in Bldg 505 and performs various cleaning, plating, and baking processes.

PROFILE OVERVIEW

- GENERAL INFORMATION
- INTERVIEWS
  - WORKLOAD
  - REPAIR PROCESS
  - STAFF
  - EQUIPMENT
  - ENGINEERING SUPPORT
  - WORK SCHEDULE
  - Changes (problems and suggestions)

DATABASE

- PROCESS FLOW CHARTS (GENERIC), (INDIVIDUAL PCNS)
- FACILITY LAYOUT
- EQUIPMENT
- WORKFORCE
- REPAIR PROCESS TECHNOLOGY
- WORKLOAD VOLUME & MIX
- MATERIAL HANDLING
- STORAGE

INTRODUCTION TO PROCESS

ELECTRODEPOSITION: PROCESS OF DEPOSITING A SUBSTANCE UPON AN ELECTRODE BY ELECTROLYSIS.

ELECTROLYTE: METAL SALT IONS DISOLVED IN A SOLVENT.

CATHODE: NEGATIVELY CHARGED ELECTRODE WHICH ATTRACTS + IONS

ANODE: POSITIVELY " " " " − IONS

PROCESS VARIABLE: SOLUTION PH & CONCENTRATION, TEMPERATURE, CURRENT DENSITY, AGITATION

- CRYSTALINE FACTORS: RATE OF FORMATION; CURRENT DENSITY, AGITATION (METHOD AND DEGREE), TEMPERATURE
- CURRENT DENSITY: ↑ = ↑ PRODUCTION, ↓ CRYSTAL SIZE = THICKER FINE CRYSTALINE DEPOSIT
  - " " ; ↑↑ = ROUGH, TREED, BURNT DEPOSITS
- AGITATION: A SUPPLEMENT TO NATURAL CONVECTION
  - DIFFUSION FILM ↓ = ↓ RESISTANCE = ↓ CURRENT DENSITY ⇒ NATURAL CONVECTION
  - PURPOSE: (1) REPLENISH CATHODE DIFFUSION FILM, (2) DISLODGE GAS BUBBLES FROM WORKPIECE, (3) PREVENT STRATIFICATION OF SOLUTION.
  - TYPES: AIR, CAVITATION, SOLUTION CIRCULATION, CONVECTION, MECHANICAL
    - AIR: LOW PRESSURE AIR LINE RELEASES AIR AT BOTTOM OF TANK CAUSING A "ROLL" OF SOLUTION AS AIR RISES. (+) WATER RINSE, (−) PLATING SOLUTION
    - CAVITATION: ULTRASONIC PRESSURE WAVES EXPAND THEN COLLAPSE BUBBLES, (−) ↑ EQUIPMENT INITIAL/MAINTENANCE COSTS
    - CIRCULATION: RECIRCULATE SOLUTION TO TANK UNDER PRESSURE, (−) MUST BE SUPPLEMENTED BY CATHODE MOVEMENT
    - CONVECTION: HEATED SOLUTION RISES CAUSING CIRCULATION, (−) VERY GENTLE PROCESS, FOR VIGOROUS REQUIREMENTS MUST BE SUPPLEMENTED
    - MECHANICAL:
      - CATHODE MOVEMENT: (+) MOST POPULAR
      - PROPELLERS & PADDLES: (−) AIR INDUCTION TO SOLUTION, ↑ COSTS, MAY NOT REPLACE FILM OR MOVE GAS BUBBLES ON ENTIRE CATHODE.
      - BARRELS: LOWERED INTO SOLUTION & ROTATED, SOLUTION MOVEMENT BY ROTATION OF BARREL, ELECTRICAL CONTACT WHEN PART TOUCHES BARREL.
- TEMPERATURE ↑ = ↑ CRYSTAL SIZE, ↑ FILM REPLACEMENT = ↓ TREEING, ↓ LHE, ↓ STRESS, ↓ CRACKING
- WATER: TRACES OF IMPURITIES WILL AFFECT PROCESS
  - DISTILLED OR DEIONIZED FOR SOLUTION BATHS
  - TAP FOR RINSE, CLEANING, ETCHING, COOLING
  - RINSE: (1) MOVE QUICKLY TO RINSE FROM CLEANING OPERATION, (2) OVERFLOW WEIR TO KEEP SURFACE FREE FROM FLOATING CONTAMINATION (3) CONSTANT FLOW OF FRESH WATER, AGITATION WILL INCREASE EFFECTIVITY OF RINSE, (4) USE 2 RINSES WHERE POSSIBLE, SPRAY HARD TO REACH AREAS (5) DO NOT LEAVE PART IN RINSE TOO LONG OR IT WILL OXIDIZE.

- HYDROGEN EMBRITTLEMENT: FERROUS ALLOYS ESPECIALLY WITH HIGH CARBON ABSORB HYDROGEN DURING CLEANING, PICKLING, PLATING, AMOUNTS ARE DUE BECAUSE OF KNOWN AND UNKNOWN CAUSES. THERE IS NO ACCURATE TEST FOR AMOUNTS ABSORBED
  - IT CAUSES PART TO BE BRITTLE, THE EFFECT IS PRONOUNCED ON PARTS SUBJECTED TO ALTERNATING STRESS.
  - PREVENT BY (1) RESTRICT ELECTROLYTIC CLEANING TO THE ANODIC CYCLE (2) LIMIT PICKLING TO SHORT NONGASSING ACID DIP (3) USE PLATING SOLUTIONS WITH ↑ CATHODE EFFICIENCY, DESIGN TO REDUCE EMBRITTLEMENT
  - REMOVE BY HEAT, (-) CADMIUM & ZINC COATED PARTS SEAL IN HYDROGEN
- ANODE FACTORS: PURITY, POSITION, LENGTH, SHAPE, EFFICIENCY, ELECTROLYTE TYPE, CURRENT & CURRENT DENSITY CAPACITY, FABRICATION METHOD.
  - AFFECT: DEPOSIT DISTRIBUTION, ↓ SOLUTION CONTAMINATION, ↓ CHEMICAL COSTS, ↑ PRODUCTION EFFICIENCY, ↓ PLATING PROBLEMS
  - SOLUABLE: (-) REPLACEMENT OF CHEMICAL ADDITIVE (
  - INSOLUABLE: (-) SPACING BETWEEN ANODE/CATHODE, EXCESSIVE BUILDUP, OXIDIZE IN BATH WITH ORGANIC OR CYANIDE AGENTS
  - ANODE CURRENT DENSITY MUST BE ↑ TO PERMIT DISSOLUTION ↓ TO PREVENT PASSIVATION
- FILTRATION CONTINUOUS OR BATCH FILTRATION
  - CONTAMINATION FROM: ANODE, AIRBORN DUST, DRAG IN, CHEMICALS, AIR AGITATION
  - PREVENTATIVE MEASURES: BAG ON PURE ANODE, PROPER CLEANING, THOROUGH RINSING
  - FILTRATION SYSTEM SIZE & TYPE BASED ON WORKLOAD, CONTAMINATION, SOLUTION
- FIXTURE (RACK) DESIGNED TO HOLD ONE OR MORE PARTS, POSSIBLE EVEN AUXILARY ANODE MATERIAL & THICKNESS DETERMINED BY STRUCTURE, ELECTRICAL, CRANE CAPACITY, TANK ENVELOPE SIZE. GOOD DRAINAGE, REDUCE GASSING, CURRENT DISTRIBUTION, PREVENT AIR/GAS POCKETS, # PARTS ON FIXTURE DETERMINED BY WEIGHT, SIZE, ELECTRICAL, PART SPACING, TOTAL SIZE FOR SMALLEST TANK ENVELOPE IN PROCESS,
- PART MUST BE SUBMERSED TWO INCHES BELOW SURFACE

- STRESS RELIEF HEAT BAKE OR SHOT PEEN
- CLEANING CRITICAL TO PLATING
  - SOLVENT VAPOR DEGREASE FOR GREASE, LOOSE PARTICLES
  - EMULSION ORGANIC SOLVENT-DETERGENT-WATER FOR LOOSENING & FLUSHING
  - ALKALINE ALKALINE FOR GREASY MATERIAL OR 2nd clean AFTER EMULSION
  - ELECTROLYTIC ALKALINE FOR SCRUBBING ACTION (-) CONTAMINATED EASILY (-) NEED TO CHANGE FOR METAL
  - ACID PICKLING (-) HIGH HYDROGEN EMBRITTLEMENT
  - MECHANICAL FOR PAINT & SOIL RUST & SCALE REMOVAL
    - ABRASIVE BLAST ROUGHEN SURFACE FOR PLATING/BONDING MATTE SURFACE FINISH
    - (WET / DRY) HAND MANUAL REMOVE: BURRS, METAL FEATHERS, FUZZ
    - (+) ↓ COST COMPARED TO OTHERS (↓ $: MANHOUR, EQUIPMENT, MAINTAINING TRAINING)
    - (-) MUST BE DRY/OIL FREE

NOTE: ELECTRO CLEAN (DIRECT / REVERSE / PERIODIC)

ANODIC (WORK IS ANODIC)

REMOVE METALLIC SMUTS, PREVENTS NONADHERENT METALLIC FILM DEPOSITION

(+) NO HYDROGEN EMBRITTLEMENT, (-) NOT FOR ALUM, CHROM, LEAD, MISC ALKALINE SOLUTIONS

CATHODIC (WORK IS CATHODIC)

(-) POOR ADHESION, ROUGHNESS, STAINING, HYDROGEN EMBRITTLEMENT

- MASKANTS

WAX (-) REPEATED IMMERSIONS, ↑ PREP TIME, MUST TRIM WHILE HOT,
(-) EASILY CHIPPED, OPAQUE, ↑ CLEANING TIME

PLASTIC (+) TRANSPARENT, DOESN'T GET BRITTLE, LESS CLEANING OF PREP SURFACE
(-) SPECIAL TANKS, HIGH TEMP., LOW FLASH POINT, SMELL, LOW REUSEABILITY.

TAPES (-) ↑ APPLICATION TIME

RUBBER SHEILDS (+) REUSEBLE (-) FITS ONLY CERTAIN PARTS, CUSTOM MADE

ANODIZE COATING

GENERAL I, II USED FOR CORROSION PROTECT, ADHESION, ORGANIC FINISH FOUNDATION, ELECTRICAL [illegible]
ABRASION RESISTANCE, DETECT SURFACE FLAWS, EASILY DYED CAN USED CHROMATE, SILICATES,
LIGHT SENSITIVE MATERIALS, INVOLVED CORROSION ARE [illegible] PORES

III WEAR, ABRASION RESIST, CORROSION, ELECTRICAL INSULATOR, FOUNDATION FOR
PAINTS, ADHESIVES, DRY FILM LUBRICANTS
NOT FOR DIMENSIONAL RESTORATION REWORK
REDUCES FATIGUE LIFE SO SHOT PEEN FIRST FOR COMPRESSIVE LAYER

SEAL I, II USED 5% SODIUM DICHROMATE GRANULES OR boiling deionized WATER or NICKEL COBALT ACETATE
DYED HOT AQUEOUS NICKEL COBALT ACETATE
III FOR MAX ABRASION RESIST DO NOT SEAL
OTHERWISE 5% sodium dichromate OR HOT AQUEOUS NICKEL COBALT ACETATE

AGITATION: AIR, MECHANICAL MIXERS, SOLUTION RECIRCULATION ETC to reduce heat

ALODIN COATING

GENERAL: CHEMICAL OXIDATION NOT ELECTROCHEMICAL LA ANODIZE. No fatigue life loss
THINNER COATS CAUSE EASILY DAMAGED SURFACE OTHERWISE GOOD ALT TO ANODIZE
CLEANING IS CRITICAL
(1) CORROSION RETARDATION UNDER ORGANIC FINISHES, (2) ADHESION UNDER ORGANIC FINISH
(3) No change in ELECTRICAL CONTACT, (4) [illegible] WEAR, (5)

STRIP ANODIZE
ANODIZE I, II, III
CONVERSION COAT

CADMIUM ELECTRODEPOSITION

PURPOSE: PROTECT STEEL, CAST IRON AGAINST ATM. CORROSION. CADMIUM PROTECTS BY SACRIFICIAL MEANS

ON FERROUS PARTS, ALUMINUM, COPPER ALLOYS PARTS FROM DISSIMILAR METAL CORROSION

GOOD SOLDERABILITY, LOW CONTACT RESISTANCE (ELECTRICAL APPLICATIONS)

OUTDOOR, INDUSTRIAL ZINC IS BETTER / INDOOR, MARINE CADMIUM IS BETTER

MORE EXPENSIVE THAN ZINC. LESS APT TO CAUSE Hydrogen Embrittlement

CORROSIVE PRODUCTS LESS VOLUMINOUS.

NOT REC FOR STEEL TENSILE ↑ 240,000 PSI

APPL. AFTER ALL HEAT TREATMENTS AND MACHINING / WELDING

UNDERPLATING: ALUM W ZINCATE COATING AND NICKEL STRIKE, CORROSION RESISTANT ALLOYS W NICKEL COATING

TANK: LOW CARBON STEEL, STAINLESS STEEL, PLASTIC, HARD RUBBER

FILTRATION: CONTINUOUS, 2 TURNOVERS 2/HR

AGITATION: MECHANICAL SUGGESTED UNLESS SOLUTION FILTRATION PROVIDES ENOUGH

STRIP

PLATE FERROUS METALS OTHER THAN LANDING GEAR

" HIGH STRENGTH STEELS " " " " ABOVE 180,000 PSI

" " " " LANDING GEAR " " "

CHROMIUM ELECTRODEPOSITION

PURPOSE: HARD, RESISTANT TO ABRASION, HEAT, TARNISH, STAIN, WEAR, REFLECTIVE, ↓ coefficient friction, Anti galling,

COATED W NICKEL OR copper nickel / good ATM CORROSION RESISTANCE

APPL. AFTER ALL MACH, HT, WELDG

UNDERPLATING: DIRECT ON ... ALUM W/ ZINCATE, NIC. STRIKE OR USED FOR CORROSION W NICKEL & copper nickel

CHROMIUM OVER CHROMIUM IS OKAY IF NOT BEEN USED

TANK: STEEL LINED WITH LEAD, BRICK OR PLASTIC

FILTRATION: PERIODIC 4 TURNOVER 1/HR

AGITATION: MECHANICAL OR LOW PRESSURE FILTER AIR IN NEEDED

STRIP

PLATE ALUMINUM ALLOYS

STEEL PARTS OTHER THAN LANDING GEAR

STAINLESS STEEL, NICKEL, COBALT

HIGH STRENGTH STEEL LANDING GEAR COMPONENTS

CHROMIUM OVER CHROMIUM

ELECTROLESS NICKEL PLATING

PURPOSE: FURNISHED WITH AUTOCATALYTIC CHEMICAL REDUCTION GIVING DEPOSITION RATHER THAN ELECTRICAL CURRENT. NONPOROUS, BRITTLE, HARD DUCTILE W/HEAT TREATMENT WITH HARDNESS OF HARD CHROMIUM ~ 70+ PLATES EQUALLY REGARDLESS OF SHAPE

UNDERPLATE: DIRECT EXCEPT (1) CORROSION RESISTANT STEEL WITH NICKEL FROM WOODS NICKEL, (2) CORROSION WITH COPPER, (3) ALUMINUM WITH NECESSARY STRIKES

AGITATION: PART OR SOLUTION MOVEMENT AVOID VIGOROUS

STRIP

PLATE ALUMINUM ALLOY

PLATE STEEL

PLATE CORROSION RESISTANT STEEL, HIGH STRENGTH STEEL, COBALT AND NICKEL BASE ALLOYS

PLATE TITANIUM ALLOYS

NICKEL -CADMIUM

PURPOSE: MANF BY APPLYING CADMIUM OVER NICKEL PLATE THEN BAKE TO DIFFUSE. CORROSION RESISTANCE FOR PARTS OPERATING AT 900°F

UNDERPLATE: NICKEL DIRECT TO BASE METAL EXCEPT CORROSION RESISTANT STEELS W/ NICKEL STRIKE THAN CADMIUM DIRECT TO NICKEL

STRIP

PLATE STEEL

NICKEL ELECTRODEPOSITION

PURPOSE: GOOD CORROSION RESISTANCE, READILY MACHINED. THIN PLATE CORROSION PROTECTION, THICK PLATE COMBINED CORROSION AND WEAR, SALVAGE OF WORN/CORRODED PARTS AND ELECTROFORMING.

UNDERPLATE: NONE EXCEPT CORROSION RESISTANT STEEL ON A PRELIMINARY COATING OF NICKEL FROM A WOODS BATH, CORROSION PROTECTION WITH A PRELIMINARY copper COATING IS permissible, ALUMINUM PARTS WITH ZINCATE FOLLOWED BY NI. STRIKE

AGITATION: MECHANICAL PART OR SOLUTION MOVEMENT, AIR IF FREE AND COMPATIBLE

STRIP

PLATE STEEL

PLATE HIGH STRENGTH STEEL

PHOSPHATE COATING

GENERAL: NON REFLECTIVE, WATER INSOLUBLE, BASE FOR PAINT; prevent under paint corrosion, "BREAK IN" SURFACE FOR BEARINGS, CORROSION RESISTANCE. ONLY ITS INSUFFICIENT PROTECTION BUT ITS EXTREMELY ABSORBS IT.

"M" MANGANESE BASE: MODERATE CORROSION PROTECT, WEAR, long term storage

"Z" ZINC BASE: PREVENT GALLING IN COLD EXTRUSION/DEEP DRAWING, & sliding friction, rust protect, COATING FOR PARTS IN SERVICE

UNDERCOAT: NONE EXCEPT TEMP MASKING

~~STRIP~~

COAT FERROUS METAL

MAGNESIUM TREATMENTS

GENERAL: MAX CORROSION PROTECTION PROCESS HAE or DOW 17, WASH PRIMER COAT, 4 coats of ZINC CHROMATE VINYL RESIN PRIMER WITH TOP COAT OF ALKYD OR ALKYD-VINYL ENAMEL

DOW 1 MACHINING 101 — CHROME PICKLE TREAT (I) NOT FOR CLOSE TOLERANCE, TEMP STORAGE, ELECTRIC BONDING, TOUCH UP, BRUSH

DOW 10 SEALED CHROME PICKLE TREAT (II) COMBINATION I, III, CORROSION PROTECT, NOT CLOSE TOLERANCE,

DOW 7 MACHINING D-7 DICHROMATE TREAT (III) paint protect, no dimension change, After machine prior to plate assembly

DOW 9 MACHINING D-9 GALVANIC ANODIZE (IV) ALT TO III, NO DIMENSION CHANGE

DOW 12 CAUSTIC ANODIZE (V) ELECTROCHEMICAL 2 layer COAT, HARD, BRITTLE, ABRASION RESIST, PAINT BASE

VARIOUS TYPE HAE MOST COMMON, prolonged general protection

DOW 19 MACHINING D-19 CHROMIC ACID (VI), BRUSH ON, TEMP STORAGE, TOUCH UP

MAGNESIUM ELEKTRON FLUORIDE ANODIZE (VII), ELECT-CHEM FOR ALL MAG, NO DIMENSION CHANGE, BASE FOR I, III, IV

IRIDITE 15 CHROMATE (VIII) (IMMERSION OR BRUSH), like III, substitute for I, III, ~~IV~~ IV, NO DIM CHANGE, PAINT BASE

PASSIVATION COATING

GENERAL: FOR AUSTENITIC, FERRITIC, MARTENSITIC, PRECIPITATION HARDENED CORROSION-RESISTANT STEEL. REMOVAL OF EMBEDDED PARTICLES AND OXIDE FILM TO IMPROVE CORROSION RESISTANCE.

I LOW TEMP

II MED TEMP

III HIGH TEMP

IV LARGE AMOUNTS OF SULFUR OR SELENIUM

V ANODIC FOR HIGH CARBON MARTENSITIC 440 STEELS

VI LOW TEMP (OPTIONAL)

AUSTENITIC 300 CORROSION RESISTANT STEELS W/OUT SULFUR OR SELENIUM

FERRITIC 400 } CORROSION RESISTANT STEELS W/OUT SULFUR OR SELENIUM
MARTENSITIC 400 }

OF AUSTENITIC MARTENSITIC PRECIPITATION HARDENED CORROSION RESISTANT STEELS WITH LARGE AMOUNTS OF SULFUR SELENIUM

303, 303Se, 347Se, 416, 416Se, 430F, 430Se

HIGH CARBON MARTENSITIC 440 CORROSION RESISTANT STEELS

440F, 440Se CORROSION RESISTANT STEELS

SILVER ELECTRODEPOSITION

GENERAL: MALLEABLE DUCTILE METAL, HEAT/ELECTRICAL CONDUCTOR, CORROSION/OXIDATION RESISTANT BUT TARNISHES AROUND SULFIDE, ANTIGALLING, REFLECTIVE, SOLDERABLE,
Due to Anti GALLING effect its used for bushings, sleeves, AIRCRAFT, Turbine engines ELECTRICAL GUNS ELECTRICAL CONTACTS, WAVE-GUIDES, TRANSFER OF CURRENT are Under-plating for Gold, rhodium, lead Alloy.

UNDERPLATE: Applied silver strike coat on nickel or nickel copper on steel/zinc Alloy or Copper Alloy
AGITATION: Req for smooth finish by cathode movement with solution movement. No air

STRIP

PLATE ALUMINUM ALLOYS
" STEEL
" STAINLESS STL, COBALT, NICKEL

TIN ELECTRODEPOSITION

GENERAL: SOFT, DUCTILE CORROSION, STAIN, TARNISH RESIST, POOR WEAR/ABRASION RESIST
Used on piston, rings to prevent seizing/scoring cylinder. Good brazing solderable
Good corrosion protect stopoff in nitriding

UNDERPLATE: DIRECT EXCEPT ALUMINUM WITH ZINCATE
AGITATION: MILD PART MOVEMENT AVOID SOLUTION AGITATION.

STRIP

PLATE ALUMINUM
" STEEL

— BRUSH PLATING

GENERAL: APPLICATION OF CONCENTRATED ELECTROLYTE SOLUTIONS ON SELECTED AREAS WITHOUT IMMERSION TANKS.

THE PART (CATHODE) IS BRUSHED WITH A STYLUS (INERT ANODE) PREVIOUSLY DIPPED IN SOLUTION. DISTRIBUTION DEPENDS ON UNIFORM CONTACT TIME ON ALL AREAS BEING PLATED.

(+) PREVENT/MINIMIZE: DISASSEMBLY, MACHINING, MASKING $; PLATE: SMALL AREAS ON LARGE PARTS, HIGH STRENGTH STEEL, DIFFICULT TO PLATE PARTS; RESTORE WORN, CORRODED, OR OVERMACHINED PARTS; NO HYDROGEN EMBRITTLEMENT

CAPABILITIES: ALUMINUM ANODIZE; BRASS, CADMIUM, COPPER, GOLD, NICKEL, NICKEL TUNGSTEN, SILVER PLATE COBALT, NICKEL COBALT, PLATINUM

— SOLID (DRY) FILM LUBRICANTS

GENERAL: USED AT HIGH TEMPERATURES (500°F) IN VACUUMS, dirty CONDITIONS, WHERE CONVENTIONAL LUBRICANTS MAY CONTAMINATE PART, AND WHERE RE-LUBRICATION IS DIFFICULT TO DO, ANTI FRETTING COATING FOR CLOSELY MATED PARTS UNDER VIBRATION, sliding, ANTI SEIZE FOR THREADED PARTS AND OTHER PARTS THAT ARE NOT USED ~~FREQUENTLY~~

Application is ~~like~~ similar to PAINT (SPRAYED, BRUSHED, ROLLED, AND IMMERSED)

MUST BE FREE FROM PRESERVATIVES, OILS, LACQUERS, ETC.

19508N WORK CONTROL DOCUMENT (MEDS)	1. DATE 89212	PAGE 1 OF __ PAGES

2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED
74521A		MNPGP		

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.
3G61039-101	4S-1-182 4S2-59-2	

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
C141 NOSE	1620007575889	

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN (THREADED)

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"

GOVERNING DIRECTIVES: AFLCR 66-51
MANOI 66-3

F.M.P.I. IAW MIL-STD-1949
P/D N01561
STRIP CHROME IAW MIL-STD-871
GRIND IAW MIL-STD-866
TEMPER ETCH IAW MIL-STD-867
SHOT PEEN IAW MIL-S-13165
CHROME PLATE IAW MIL-STD-1501
FPI IAW MIL-STD-6866
CAD PLATE IAW MIL-STD-870
BAKE IAW 4S-1-182
MAOI 74-12
VAD I.V.D. ALUM IAW MIL-C-83488A
ALODINE IAW MIL-C-5541
***4140 STEEL 180,000/200,000 PSI**
****UNIT COST 3G61014-101 $189.43***
*** UNIT COST 3G61039-101 $115.30***
ALL PERSONNEL INVOLVED IN THE WORK PROCESSES IN THIS DOCUMENT HAVE BEEN THOROUGHLY TRAINED AND ARE FAMILIAR WITH ALL PERTINENT SAFETY PRACTICES AND HAZARDS CONTAINED IN THE BASIC TECHNICAL ORDER (T.O.) AND T.O. SUPPLEMENTS REFERENCED IN BLOCK 8 OF THIS AFLC FORM 958. THE APPLICABLE T.O.'S AND SUPPLEMENTS WILL ALWAYS BE USED IN CONJUNCTION WITH THIS DOCUMENT.
*COMPONENTS WILL BE THOROUGHLY CLEANED & PROTECTED (C/P MOVE) FOR MOVES BETWEEN OPERATIONS/DISPATCH STATIONS.

WARNING

MANY OF THE FOLLOWING REPAIR PROCEDURES REQUIRE THE USE OF EQUIPMENT, PROCESSES & CHEMICALS WHICH ARE POTENTIALLY DANGEROUS TO
(CONTINUED)

21. FINAL DESTINATION DISPATCH	FUNCTIONAL CODE	22. COORDINATION/INITIATING RCC SIGNATURE/DATE A	C	23. DOCUMENT/SN
				19508N
		B	D	

AFLC FORM 958 NOV 80 PREVIOUS EDITION WILL BE USED

19508N WORK CONTROL DOCUMENT (MEDS)

1. DATE	PAGE
89212	PAGE 2 OF __ PAGES

2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	**14. NOUN**	
	TRUNNION PIN (THREADED)	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		PERSONNEL. ADEQUATE SAFEGUARDS AND PRECAUTIONS MUST BE EMPLOYED TO PRECLUDE INJURIES.			
		REQD (MANDATORY REQUIREMENT) IN COLUMN 16 IS EQUIVALENT TO DELTA STAMP.			
	001	3G61039-101			
34D	005 *REQD*	DISASSEMBLE *C/P MOVE		M	
34C	007 *REQD*	CHEM CLEAN *C/P MOVE		M	
34B	009 *REQD*	BLAST CLEAN *C/P MOVE		M	
34B	011 *REQD*	BAKE 4 HRS AT 350-400F DATE IN____________TIME IN____________			
		DATE OUT____________TIME OUT____________ *C/P MOVE			
34M	013 *REQD*	FMPI *C/P MOVE	M	K	
34E	030 *REQD*	E AND I INSPECTION PIN LARGE DIAMETER O.D. (CONTINUED)			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
DISPATCH	FUNCTIONAL CODE	A	C	19508N
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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN (THREADED)

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		3.8105/3.8125 WEAR 3.8098 PIN SMALL DIAMETER O.D. 2.3097/2.3112 WEAR 2.3092 PIN I.D. LARGE AREA 3.452 MAX			
		PIN I.D. SMALL AREA 1.600 MAX PIN I.D. THREADED AREA 1.030 MAX CROSS BOLT HOLE I.D. 0.625/0.626 *NOTE*IT IS NOT ECONOMICALLY			
		FEASABLE TO REPAIR THIS ITEM IF GRINDING OR PLATING IS REQUIRED IDETIFY TO MMIL ON AFLC 103 FOR DISPOSITION.			
		*C/P MOVE			
26	032	VAPOR DEGREASE *C/P MOVE			
26	034	STRIP CAD *C/P MOVE			
26	036	STRIP RUST *C/P MOVE			
26	040	STRIP CHROME FROM LARGE DIAMETER *C/P MOVE			
26	050	STRIP CHROME FROM SMALL DIAMETER *C/P MOVE			
8	060	FIRST GRIND LARGE DIAMETER CLEANUP MINIMUM O.D. 3.800 32 RMS 3G61039-101 (CONTINUED)			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
DISPATCH	FUNCTIONAL CODE	A	C	19508N
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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN (THREADED)

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		*C/P MOVE			
8	080	FIRST GRIND SMALL DIAMETER CLEANUP MINIMUM O.D. 2.285 32 RMS P/N 3G61039-101 THREADED PIN *C/P MOVE			
8	085	GRIND CROSS BOLT HOLE TO CLEAN UP NOT TO EXCEED .0641 MAX *C/P MOVE			
26	090	TEMPER ETCH TIME OUT__________DATE OUT__________ *C/P MOVE	M	K	
		* * * * * * * N O T E * * * * * * * * IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26B	100	BAKE 4 HRS AT 350 TO 400F WITHIN 8 HRS OF ETCH DATE IN________TIME IN________			
		DATE OUT________TIME OUT________ *C/P MOVE			
8A	110	FMPI *C/P MOVE * * * * * * * N O T E * * * * * * * * IF LAST NDI OPERATION IS COMPLETED*	M	K	
		HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	115	VAPOR DEGREASE *C/P MOVE			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	**14. NOUN**	
	TRUNNION PIN (THREADED)	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
26	120	SHOT PEEN LARGE DIA INTENSITY .008/.012 A2 *C/P MOVE		M	
26	122	SHOT PEEN SMALL DIA INTENSITY OF .008/.012 A2 *C/P MOVE		M	
26	125	PREPARE FOR CHROME PLATING OF LARGE O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED__________		M	
26	130	CHROME PLATE LARGE O.D. SUFFICIENT TO GRIND BACK TO 3.8105/3.8125 TYPE II CLASS III ~~MECHANIC SIGN OFF REQUIRED~~--------->		M	
		*C/P MOVE			
26	135	PREPARE FOR CHROME PLATING OF SMALL O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED__________		M	
26	140	CHROME PLATE SMALL O.D. SUFFIC- IENT TO GRIND BACK TO FINISHED DIM- ENSION OF 2.3097/2.3112 TYPE II ~~CLASS III~~		M	
		DATE OUT__________TIME OUT__________ MECHANIC SIGN OFF REQUIRED--------> *C/P MOVE			
26B	150	BAKE 4 HRS AT 350 TO 400F WITHIN 4 HRS OF CHROME DATE IN________TIME IN________			
		DATE OUT________TIME OUT________ *C/P MOVE			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN (THREADED)

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
8	160	FINISH GRIND LARGE DIAMETER O.D. 3.8105/3.8125. CONCENTRIC WITHIN .001 32 RMS		M	
		~~RECORD WEAR DIM IF REWORK LIMITS ARE~~ EXCEEDED____ RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS____ ~~*C/P MOVE~~			
8	170	FINISH GRIND SMALL DIAMETER O.D. 2.3097/2.3112. CONCENTRIC WITHIN .001. 32 RMS		M	
		~~RECORD WEAR DIM IF REWORK LIMITS ARE~~ EXCEEDED____ RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS____ ~~*C/P MOVE~~			
26B	180	BAKE 4 HRS AT 350-400F DATE IN____TIME IN____			
		DATE OUT____TIME OUT____ *C/P MOVE			
8A	190	FMPI *C/P MOVE * * * * * * * N O T E * * * * * * *	M	K	
		~~IF LAST NDI OPERATION IS COMPLETED~~* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	195	VAPOR DEGREASE *C/P MOVE			
26A	200	FPI *C/P MOVE * * * * * * * N O T E * * * * * * * (CONTINUED)	M	K	

21. FINAL DESTINATION DISPATCH	FUNCTIONAL CODE	22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN (THREADED)

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	205	PRIOR TO CAD PLATE, GRIT BLAST ALL AREAS TO BE CAD PLATED. *C/P MOVE		M	
26	210	CAD PLATE TYPE I CLASS II .5 SQ FT AT 25-35 AMPS TIME OUT______DATE OUT______ *C/P MOVE		M	
26B	220	BAKE 24 HRS AT 350 TO 400F WITHIN 4 HRS OF CAD DATE IN______TIME IN______			
		DATE OUT______TIME OUT______ *C/P MOVE			
26	221	IRIDITE *C/P MOVE		M	
8A	223	FMPI *C/P MOVE * * * * * * * N O T E * * * * * * *	M	K	
		IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	224	VAC I.V.D. ALUM OPTIONAL NOTE: 24 HR BAKE AND F.M.P.I. MUST BE ACCOMPLISHED PRIOR TO THIS OPTION *C/P MOVE		M	
26	225	ALODINE I.V.D. ALUM *C/P MOVE		M	

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN (THREADED)

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
34PP	227 *REQD*	PRE-PAINT *C/P MOVE		M	
34A	230 *REQD*	FINAL ACCEPTANCE OF WORK CONTROL DOCUMENT FOR COMPLETENESS & ACCURACY OF ALL PRECEDING OPERATIONS THIS 958 *C/P MOVE		M	
34A	240 *REQD*	FINAL PRODUCT VISUAL INSPECTION *C/P MOVE		M	

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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74521A		MNPGP		

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.
3G61014-101	4S-1-182 4S2-59-3	

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
C141 NOSE	1620000271196	
13. SERIAL NUMBER	14. NOUN	
	TRUNNION PIN	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		GOVERNING DIRECTIVES: AFLCR 66-51 MANOI 66-3 F.M.P.I. IAW MIL-STD-1949 P/D N01561			
		STRIP CHROME IAW MIL-STD-871 GRIND IAW MIL-STD-866 TEMPER ETCH IAW MIL-STD-867 SHOT PEEN IAW MIL-S-13165			
		CHROME PLATE IAW MIL-STD-1501 FPI IAW MIL-STD-6866 CAD PLATE IAW MIL-STD-870 BAKE IAW 4S-1-182			
		MAOI 74-12 VAD I.V.D. ALUM IAW MIL-C-83488A ALODINE IAW MIL-C-5541 ***4140 STEEL 180,000/200,000 PSI**			
		****UNIT COST 3G61014-101 $189.43*** *** UNIT COST 3G61039-101 $115.30*** ALL PERSONNEL INVOLVED IN THE WORK PROCESSES IN THIS DOCUMENT HAVE BEEN			
		THOROUGHLY TRAINED AND ARE FAMILIAR WITH ALL PERTINENT SAFETY PRACTICES AND HAZARDS CONTAINED IN THE BASIC TECHNICAL ORDER (T.O.) AND T.O.			
		SUPPLEMENTS REFERENCED IN BLOCK 8 OF THIS AFLC FORM 958. THE			
		APPLICABLE T.O.'S AND SUPPLEMENTS WILL ALWAYS BE USED IN CONJUNCTION WITH THIS DOCUMENT. *COMPONENTS WILL BE THOROUGHLY			
		CLEANED & PROTECTED (C/P MOVE) FOR MOVES BETWEEN OPERATIONS/DISPATCH STATIONS. WARNING			
		MANY OF THE FOLLOWING REPAIR PROCEDURES REQUIRE THE USE OF EQUIPMENT, PROCESSES & CHEMICALS WHICH ARE POTENTIALLY DANGEROUS TO			

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21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		PERSONNEL. ADEQUATE SAFEGUARDS AND PRECAUTIONS MUST BE EMPLOYED TO PRECLUDE INJURIES.			
		REQD (MANDATORY REQUIREMENT) IN COLUMN 16 IS EQUIVALENT TO DELTA STAMP.			
	001	3361014-101			
34D	005 *REQD*	DISASSEMBLE *C/P MOVE		M	
34C	007 *REQD*	CHEM CLEAN *C/P MOVE		M	
34B	009 *REQD*	BLAST CLEAN *C/P MOVE		M	
34B	011 *REQD*	BAKE 4 HRS AT 350-400F DATE IN________TIME IN________			
		DATE OUT________TIME OUT________ *C/P MOVE			
34M	013 *REQD*	FMPI *C/P MOVE	M	K	
34E	030 *REQD*	E AND I INSPECTION PIN LARGE DIAMETER O.D. (CONTINUED)			

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	14. NOUN TRUNNION PIN	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		3.8105/3.8125 WEAR 3.8098 PIN SMALL DIAMETER O.D. 2.3097/2.3112 WEAR 2.3092 CROSS PIN HOLE .375/.376/.39 MAX **N O T E** IT IS NOT ECONOMICALLY FEASABLE TO REPAIR THIS PIN IF GRINDING AND PLATEING ARE REQUIRED IDENTIFY TO MMIL ON AFLC FORM 103 FOR DISPOSITION. *C/P MOVE			
26	032	VAPOR DEGREASE *C/P MOVE			
26	034	STRIP CAD *C/P MOVE			
26	036	STRIP RUST *C/P MOVE			
26	040	STRIP CHROME FROM LARGE DIAMETER *C/P MOVE			
26	050	STRIP CHROME FROM SMALL DIAMETER *C/P MOVE			
B	060	FIRST GRIND LARGE DIAMETER CLEANUP MINIMUM O.D. 3.800 32 RMS P/N 3G61014-101 *C/P MOVE			
8	070	FIRST GRIND SMALL DIAMETER CLEANUP MINIMUM O.D. 2.280 32 RMS P/N 3G61014-101 (CONTINUED)			

21. FINAL DESTINATION DISPATCH	FUNCTIONAL CODE	22. COORDINATION/INITIATING RCC SIGNATURE/DATE A	C	23. DOCUMENT/SN
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	14. NOUN	
	TRUNNION PIN	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		*C/P MOVE			
8	085	GRIND PIN HOLE TO MAX DIA OF .39 CONCENTRIC & PREPENDICULAR TO CENTER LINE 2.285/2.305 FROM END TO CENTER OF HOLE 32 RMS *C/P MOVE			
26	090	TEMPER ETCH TIME OUT__________DATE OUT__________ *C/P MOVE	M	K	
		* * * * * * * N O T E * * * * * * * IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26B	100	BAKE 4 HRS AT 350 TO 400F WITHIN 8 HRS OF ETCH DATE IN________TIME IN__________			
		DATE OUT________TIME OUT_________ *C/P MOVE			
8A	110	FMPI *C/P MOVE * * * * * * * N O T E * * * * * * * IF LAST NDI OPERATION IS COMPLETED*	M	K	
		HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	115	VAPOR DEGREASE *C/P MOVE			
26	120	SHOT PEEN LARGE DIA INTENSITY .008/.012 A2 *C/P MOVE		M	

21. FINAL DESTINATION DISPATCH	FUNCTIONAL CODE	22. COORDINATION/INITIATING RCC SIGNATURE/DATE A	C	23. DOCUMENT/SN
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19505N **WORK CONTROL DOCUMENT (MEDS)**

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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
26	122	SHOT PEEN SMALL DIA INTENSITY OF .008/.012 A2 *C/P MOVE		M	
26	125	PREPARE FOR CHROME PLATING OF LARGE O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED__________		M	
26	130	CHROME PLATE LARGE O.D. SUFFICIENT TO GRIND BACK TO 3.8105/3.8125 TYPE II CLASS III MECHANIC SIGN OFF REQUIRED---------->		M	
		*C/P MOVE			
26	135	PREPARE FOR CHROME PLATING OF SMALL O.D. FIXTURE/MASK/ETC. MECHANIC SIGN OFF REQUIRED__________		M	
26	140	CHROME PLATE SMALL O.D. SUFFIC- IENT TO GRIND BACK TO FINISHED DIM- ENSION OF 2.3097/2.3112 TYPE II CLASS III		M	
		DATE OUT__________TIME OUT__________ MECHANIC SIGN OFF REQUIRED---------> *C/P MOVE			
26B	150	BAKE 4 HRS AT 350 TO 400F WITHIN 4 HRS OF CHROME DATE IN________TIME IN________			
		DATE OUT________TIME OUT________ *C/P MOVE			
8	160	FINISH GRIND LARGE DIAMETER O.D. 3.8105/3.8125. CONCENTRIC WITHIN .001 32 RMS (CONTINUED)		M	

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	14. NOUN TRUNNION PIN	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		RECORD WEAR DIM IF REWORK LIMITS ARE EXCEEDED__________ RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS__________			
		*C/P MOVE			
8	170	FINISH GRIND SMALL DIAMETER O.D. 2.309 /2.311 , CONCENTRIC WITHIN .001. 32 RMS RECORD WEAR DIM IF REWORK LIMITS ARE		M	
		EXCEEDED__________ RECORD REASON & CAUSE FOR EXCEEDING REWORK LIMITS__________ *C/P MOVE			
26B	180	BAKE 4 HRS AT 350-400F DATE IN__________TIME IN__________			
		DATE OUT__________TIME OUT__________ *C/P MOVE			
8A	190	FMPI *C/P MOVE * * * * * * * N O T E * * * * * * * IF LAST NDI OPERATION IS COMPLETED*	M	K	
		HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	195	VAPOR DEGREASE *C/P MOVE			
26A	200	FPI *C/P MOVE * * * * * * * N O T E * * * * * * *	M	K	

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21. FINAL DESTINATION DISPATCH	FUNCTIONAL CODE	22. COORDINATION/INITIATING RCC SIGNATURE/DATE A	C	23. DOCUMENT/SN 19505N
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7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL
13. SERIAL NUMBER	14. NOUN	
	TRUNNION PIN	

15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
		IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	205	PRIOR TO CAD PLATE, GRIT BLAST ALL AREAS TO BE CAD PLATED. *C/P MOVE		M	
26	210	CAD PLATE TYPE I CLASS II .5 SQ FT AT 25-35 AMPS TIME OUT______ DATE OUT______ *C/P MOVE		M	
26B	220	BAKE 24 HRS AT 350 TO 400F WITHIN 4 HRS OF CAD DATE IN______ TIME IN______			
		DATE OUT______ TIME OUT______ *C/P MOVE			
26	221	IRIDITE *C/P MOVE		M	
8A	223	FMPI *C/P MOVE * * * * * * * N O T E * * * * * * *	M	K	
		IF LAST NDI OPERATION IS COMPLETED* HERE, TAKE PRODUCTION COUNT. * * * * * * * * * * * * * * * * * * *			
26	224	VAC I.V.D. ALUM OPTIONAL NOTE: 24 HR BAKE AND F.M.P.I. MUST BE ACCOMPLISHED PRIOR TO THIS OPTION *C/P MOVE		M	
26	225	ALODINE I.V.D. ALUM *C/P MOVE		M	

21. FINAL DESTINATION DISPATCH	FUNCTIONAL CODE	22. COORDINATION/INITIATING RCC SIGNATURE/DATE A	C	23. DOCUMENT/SN
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		B	D	

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2. JOB ORDER NO.	3. QUANTITY	4. PRODUCTION SEC/RCC	5. DATE SCHED.	6. DATE COMPLETED

7. PART NUMBER	8. TECH DATA	9. ITEM SERIAL NO.

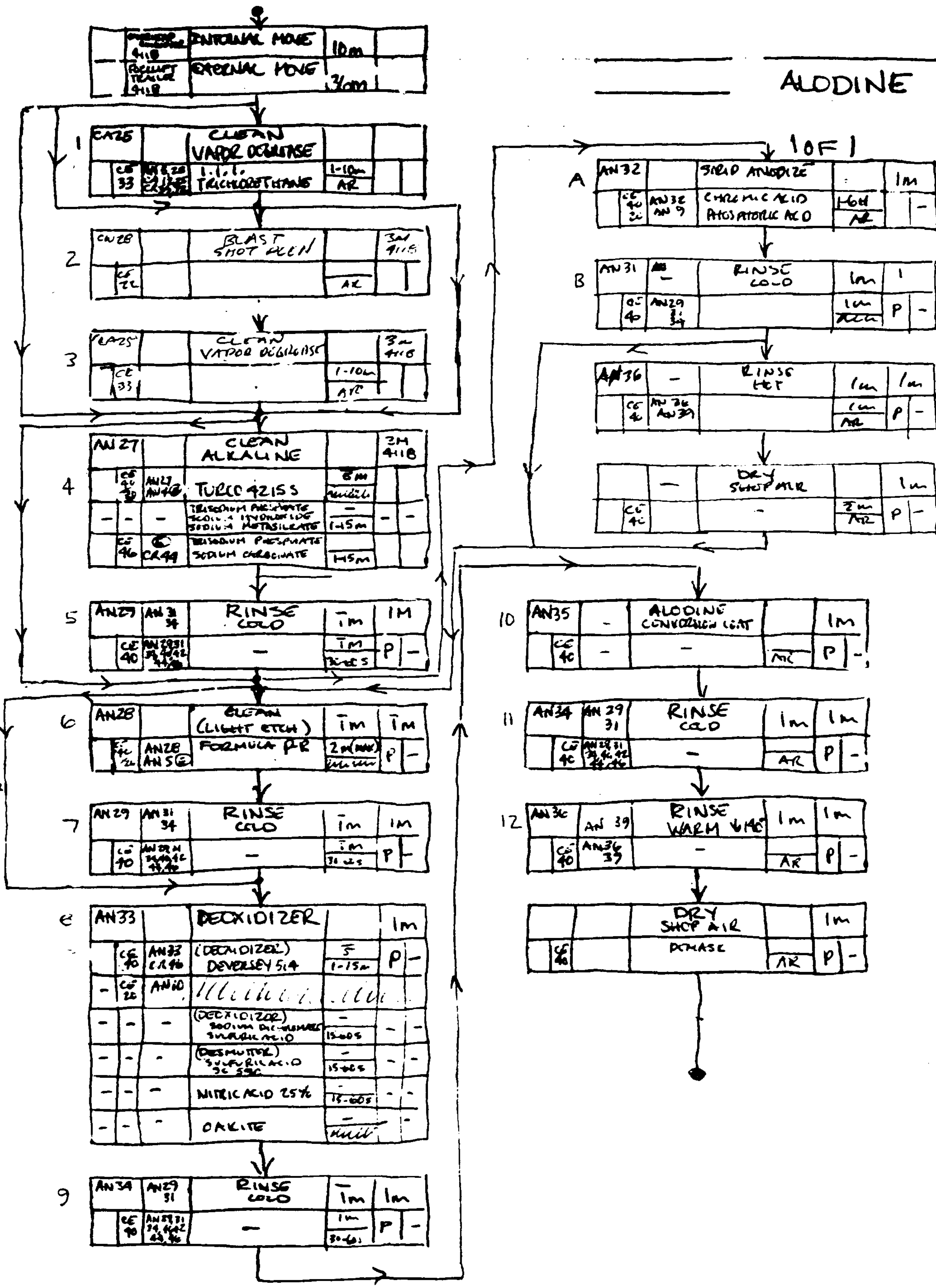
10. MODEL-DESIGN-SERIES	11. STOCK NUMBER	12. OPTIONAL

13. SERIAL NUMBER	14. NOUN
	TRUNNION PIN

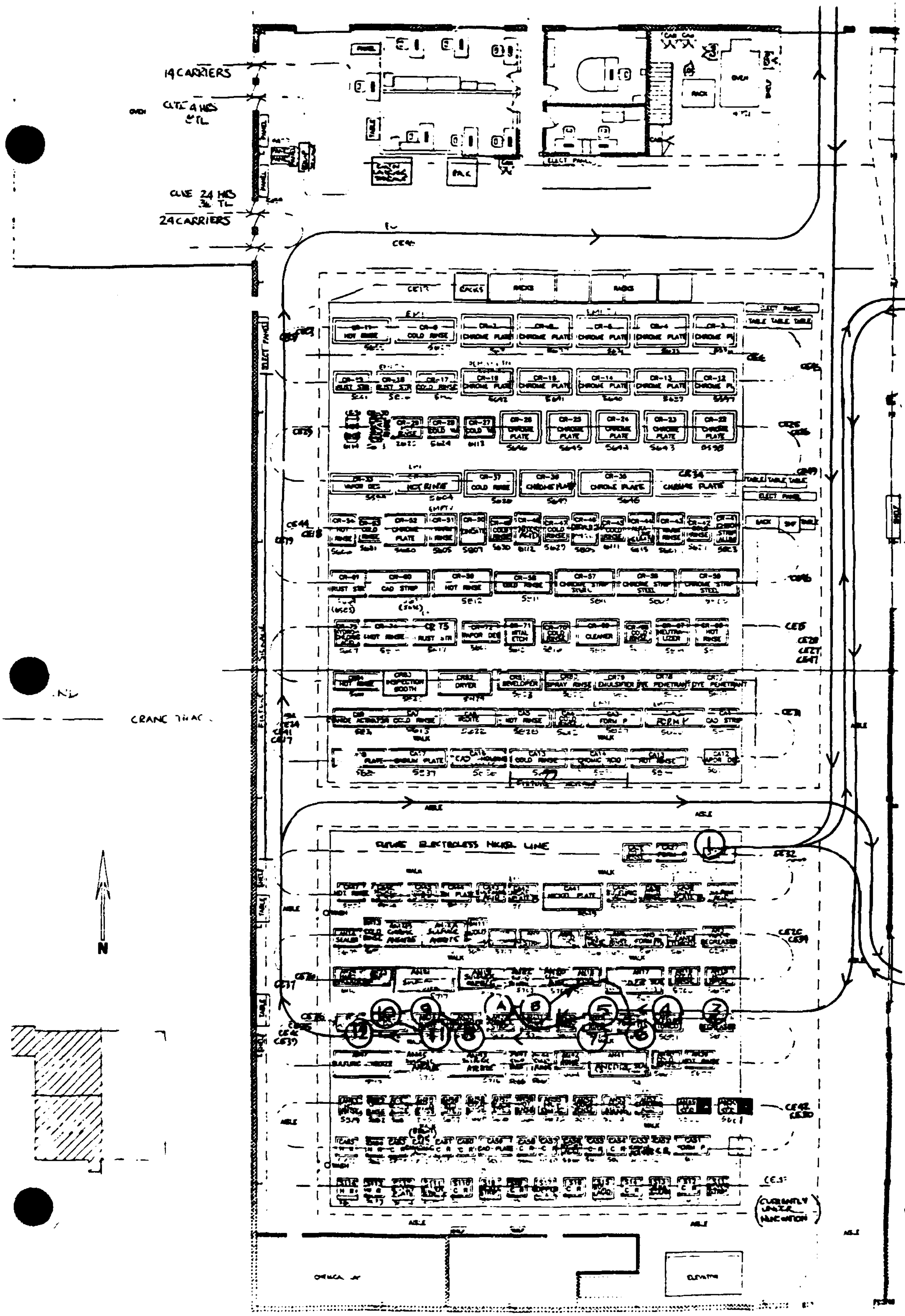
15. DISPATCH STATION	16. PERF RCC/OP NO.	17. WORK TO BE ACCOMPLISHED	18. MECHANIC	19. "P"	20. "Q"
34PP	227 *REQD*	PRE-PAINT *C/P MOVE		M	
34A	230 *REQD*	FINAL ACCEPTANCE OF WORK CONTROL DOCUMENT FOR COMPLETENESS & ACCURACY OF ALL PRECEDING OPERATIONS THIS 95B *C/P MOVE		M	
34A	240 *REQD*	FINAL PRODUCT VISUAL INSPECTION *C/P MOVE		M	

21. FINAL DESTINATION		22. COORDINATION/INITIATING RCC SIGNATURE/DATE		23. DOCUMENT/SN
DISPATCH	FUNCTIONAL CODE	A	C	19505N
		B	D	

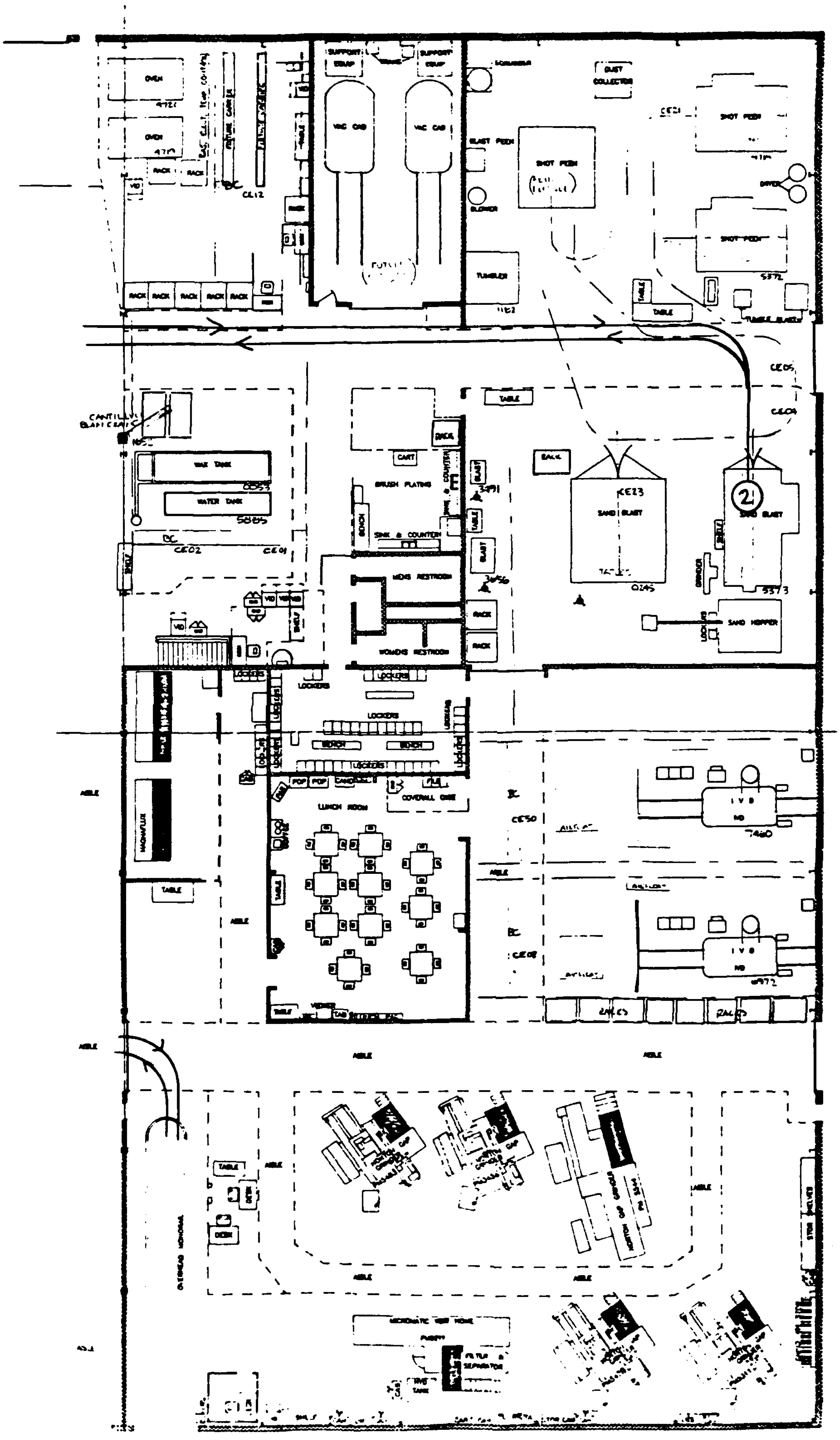
ALODINE



INTERNAL MOVE
10m
EXTERNAL MOVE
1 OF 1
1
CA25
CLEAN
VAPOR DEGREASE
1.1.1. TRICHLOROETHANE
2
CN28
BLAST
SHOT PEEN
3
CA25
CLEAN
VAPOR DEGREASE
4
AN27
CLEAN
ALKALINE
TURCO 4215S
TRISODIUM PHOSPHATE
SODIUM HYDROXIDE
SODIUM METASILICATE
TRISODIUM PHOSPHATE
SODIUM CARBONATE
5
AN29
RINSE
COLD
6
AN28
CLEAN
(LIGHT ETCH)
FORMULA P-R
IF NO "FORM P-R" THEN DEOXIDIZE FOR 10-15m
7
AN29
RINSE
COLD
8
AN33
DEOXIDIZER
(DEOXIDIZER)
DEVERSEY 514
(DEOXIDIZER)
SODIUM DICHROMATE
SULFURIC ACID
(DESMUTTER)
SULFURIC ACID
NITRIC ACID 25%
OAKITE
9
AN34
RINSE
COLD
A
AN32
STRIP ANODIZE
CHROMIC ACID
PHOSPHORIC ACID
B
AN31
RINSE
COLD
AN36
RINSE
HOT
DRY
SHOP AIR
10
AN35
ALODINE
CONVERSION COAT
11
AN34
RINSE
COLD
12
AN36
RINSE
WARM
DRY
SHOP AIR

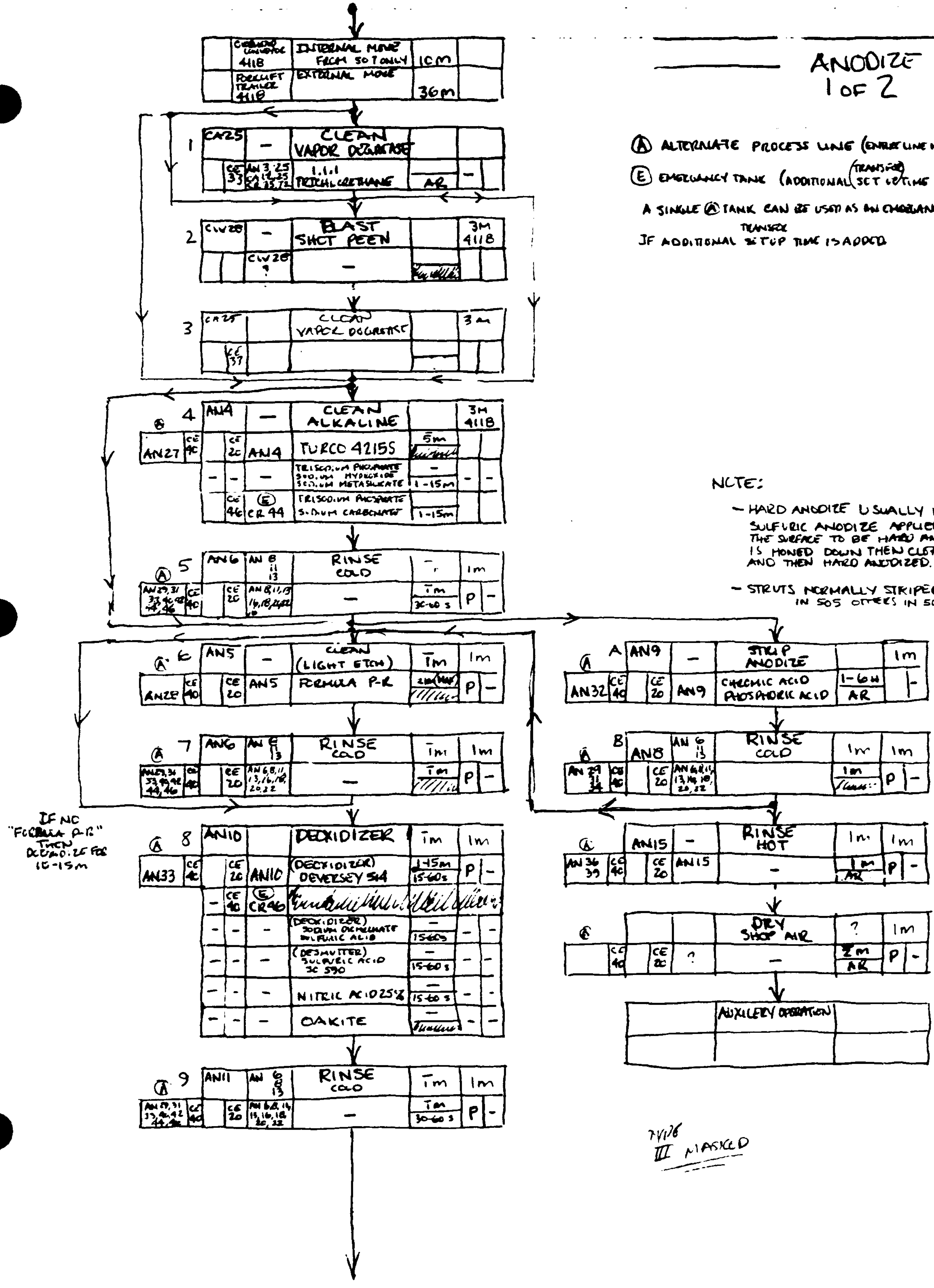


ALODINI
1 OF 2



ALODINE
2 OF 2

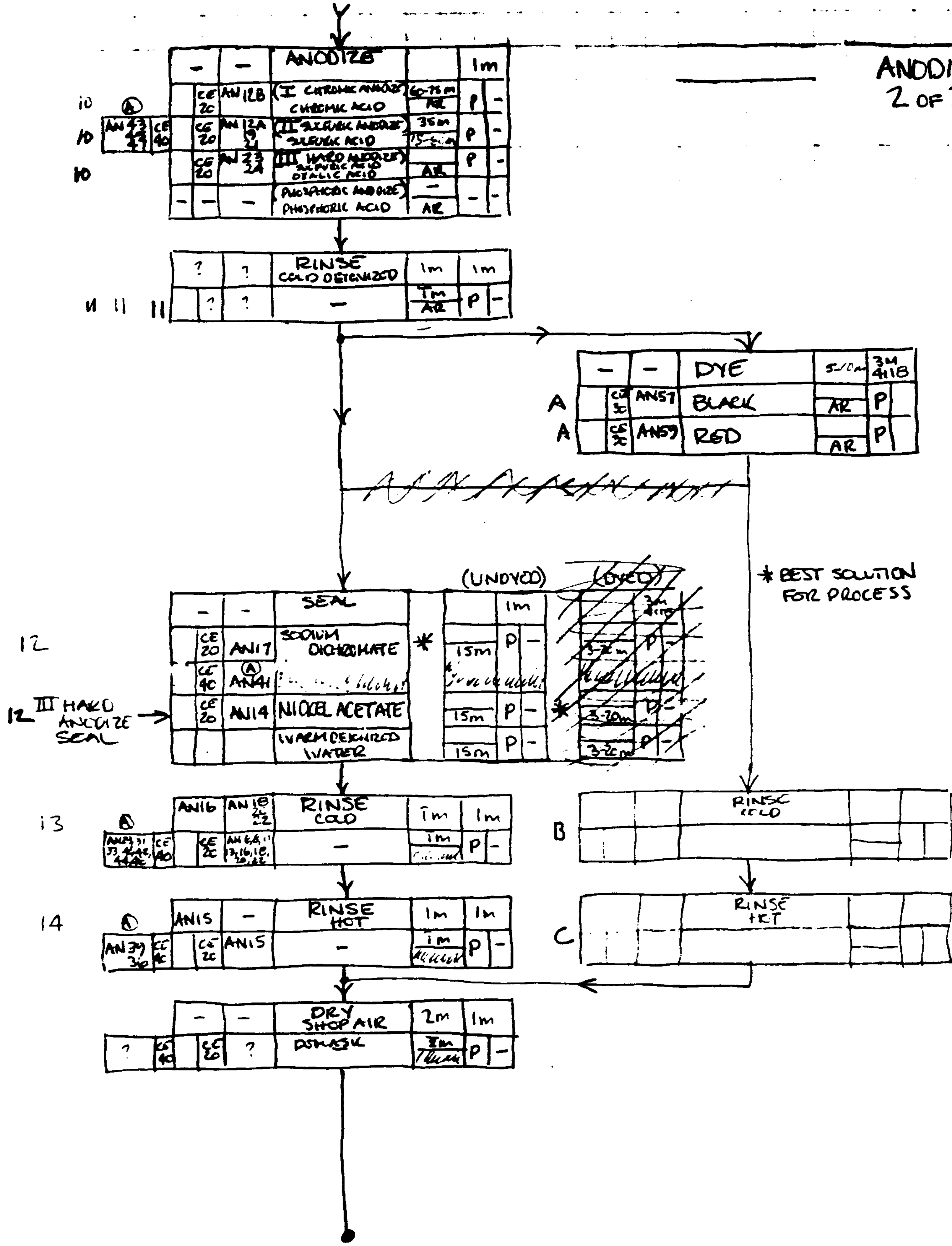
Ⓐ ALTERNATE PROCESS LINE (ENTIRE LINE MATCH)
Ⓔ EMERGENCY TANK (ADDITIONAL (TRANSFER) SET UP TIME REQUIR.
A SINGLE Ⓐ TANK CAN BE USED AS AN EMERGENCY TANK IF ADDITIONAL TRANSFER SET UP TIME IS ADDED

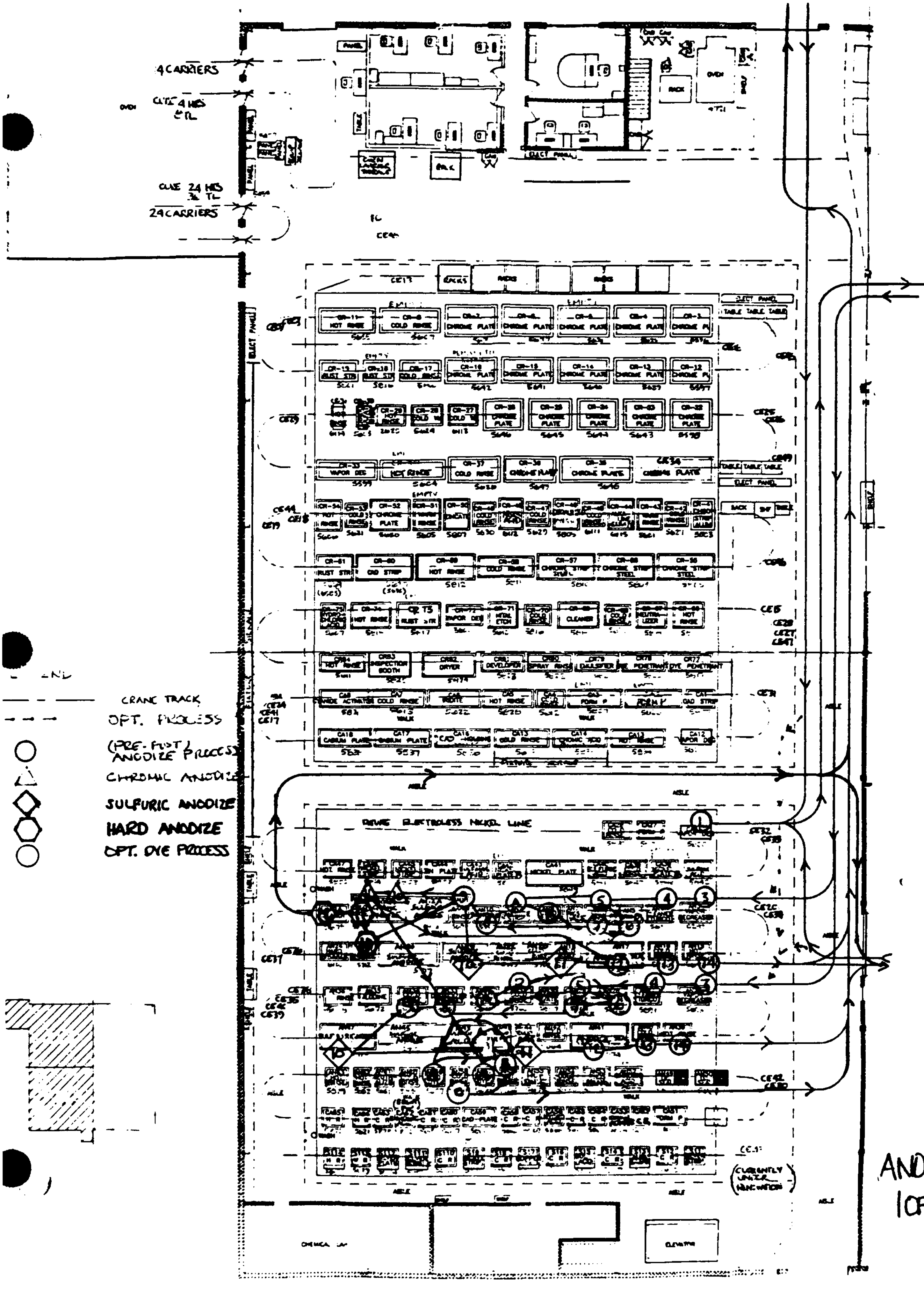


NOTE:

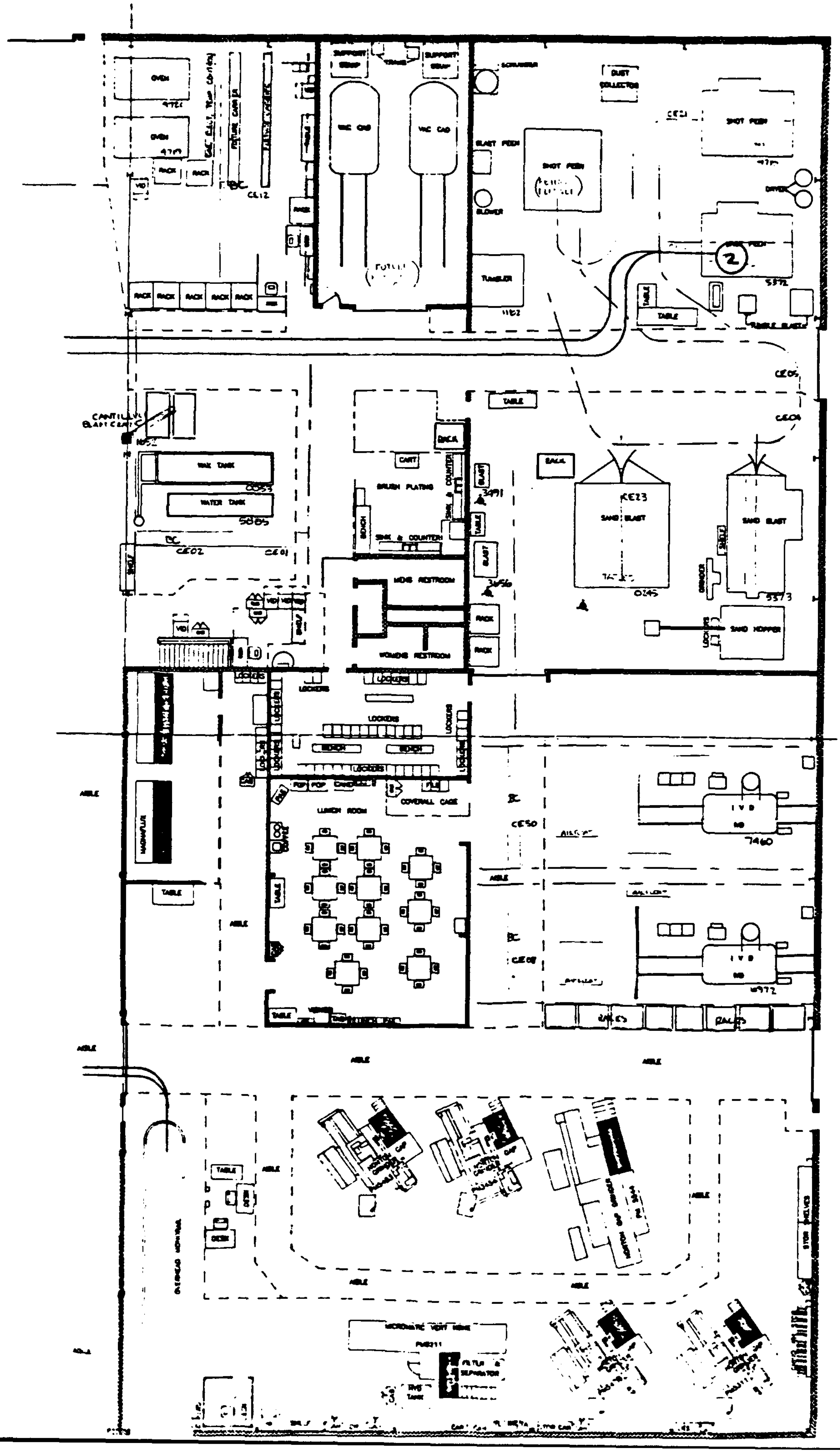
- HARD ANODIZE USUALLY HAS A SULFURIC ANODIZE APPLIED THE THE SURFACE TO BE HARD ANODIZE IS HONED DOWN THEN CLEANED AND THEN HARD ANODIZED.
- STRUTS NORMALLY STRIPPED IN 505 OTHERS IN 507

7/1/78
III MASKED


ANODIZE
1m
10
CE 20
AN 12B
I CHROMIC ANODIZE
CHROMIC ACID
60-75 m
AR
P
10
AN 43
CE 40
CE 20
AN 12A
II SULFURIC ANODIZE
SULFURIC ACID
35 m
P
10
CE 20
AN 23 24
III HARD ANODIZE
SULFURIC ACID
OXALIC ACID
AR
P
PHOSPHORIC ANODIZE
PHOSPHORIC ACID
AR
RINSE
COLD DEIONIZED
1m
1m
11 11 11
?
?
1m
AR
P
DYE
3M 4118
A
CE 30
AN57
BLACK
AR
P
A
CE 30
AN59
RED
AR
P
(UNDYED)
(DYED)
* BEST SOLUTION FOR PROCESS
SEAL
1m
12
CE 20
AN17
SODIUM DICHROMATE
*
15m
P
3-20m
P
CE 40
AN41
III HARD ANODIZE SEAL
12
CE 20
AN14
NICKEL ACETATE
15m
P
*
3-20m
P
WARM DEIONIZED WATER
15m
P
3-20m
P
13
AN16
AN 18 22
RINSE
COLD
1m
1m
CE 40
CE 20
1m
P
B
RINSE
COLD
14
AN15
RINSE
HOT
1m
1m
AN 39
CE 40
CE 20
AN15
1m
P
C
RINSE
HOT
DRY
SHOP AIR
2m
1m
?
CE 40
CE 20
?
1m
P



ANODIZE
1 OF 2

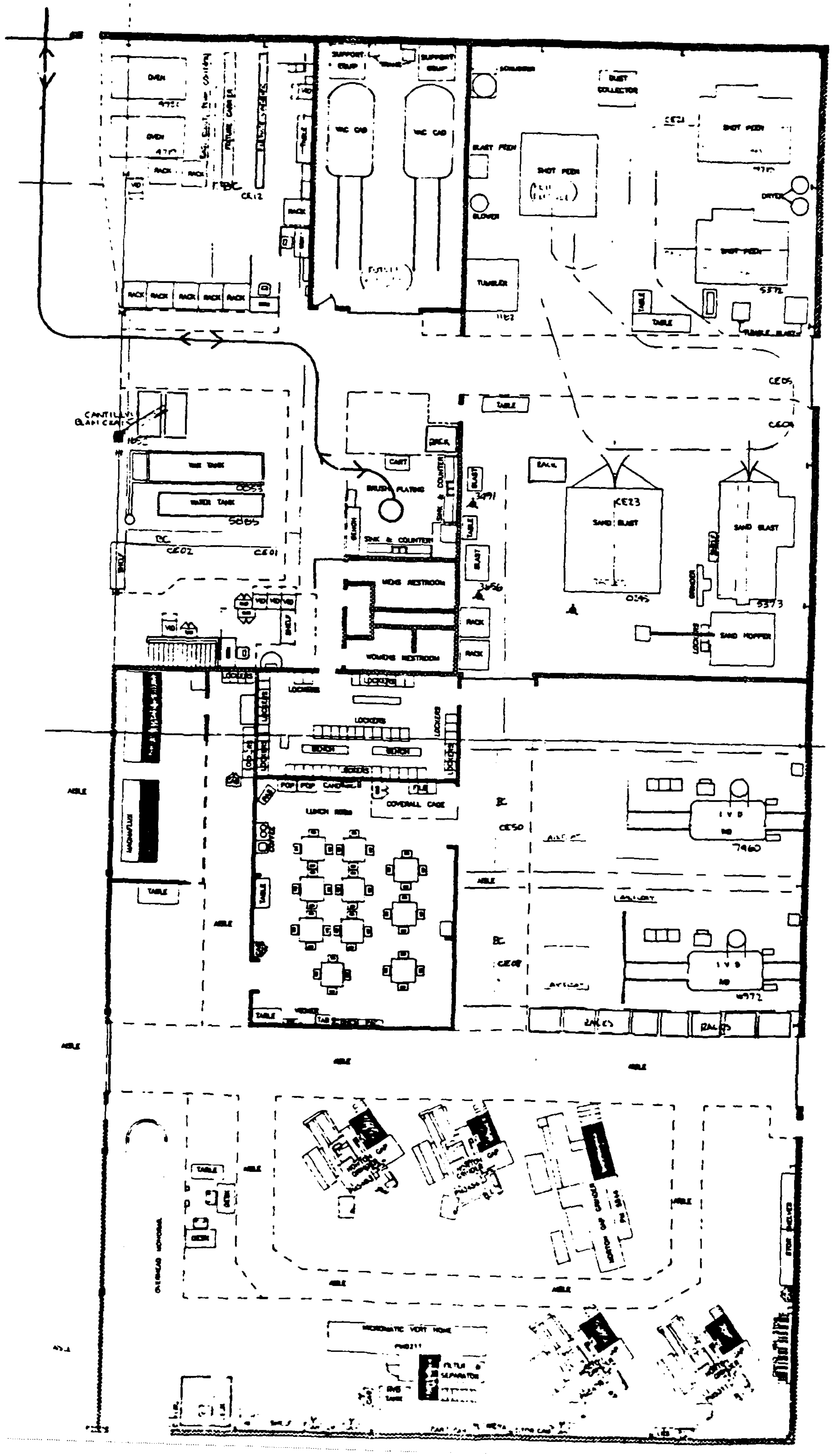


ANODIZE
2 OF 2

BRUSH

THIS PROCESS IN MAINLY USED IN MANPRC BUT CAN BE MOBILE, IT IS NORMALLY USED AS A REPAIR OF NICKS, ETC, BUT IS ALSO USED IN EMERGENCIES INSTEAD OF IMMERSION PROCESSES. DO TO THE NATURE OF THE PROCESS A FLOW CHART CAN NOT ILLUSTRATE THE PROCESS,

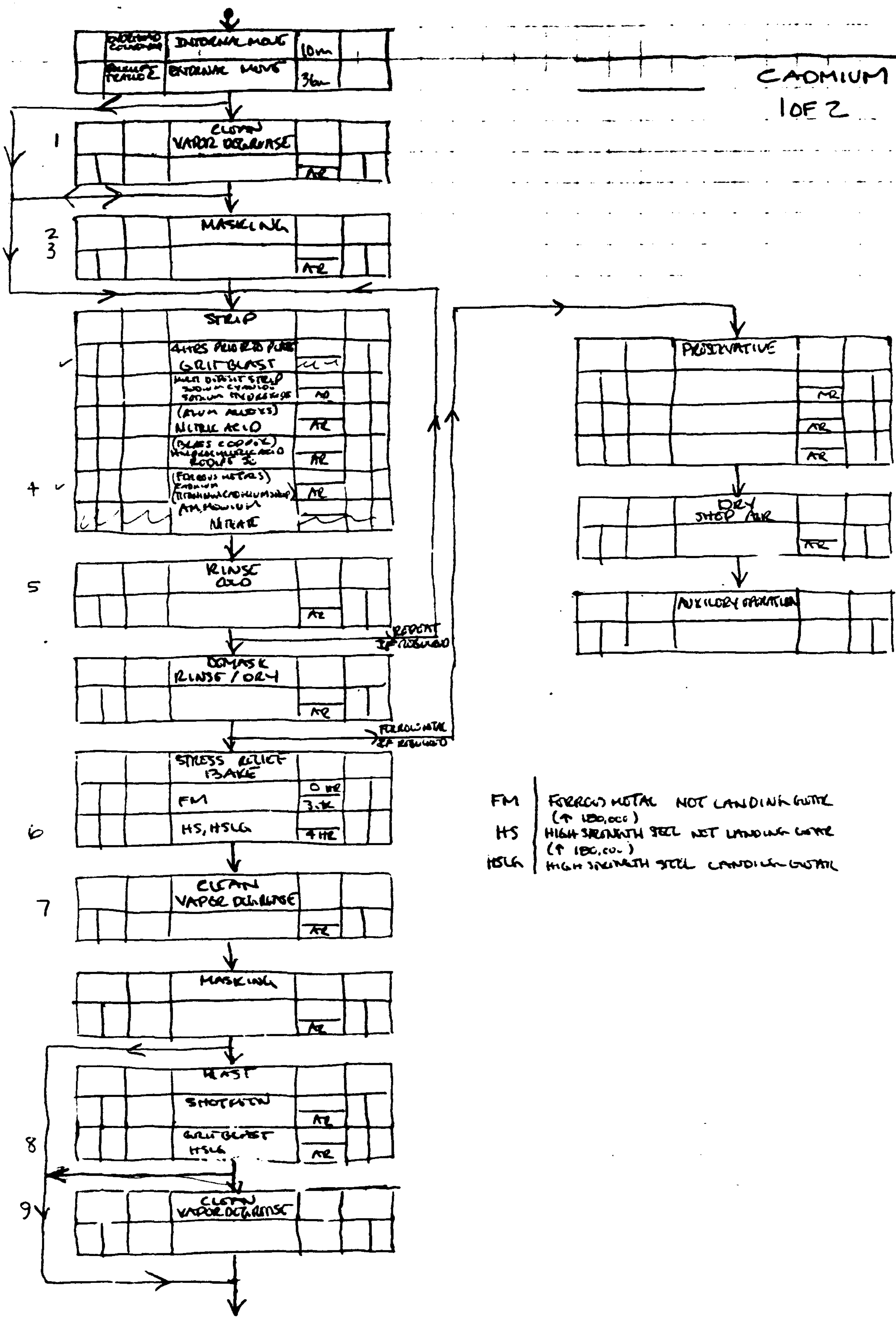
CAPABILITIES ARE:	ESTIMATED WORKLOAD
ALUMINUM ANODIZE	1/MO
BRASS	
CADMIUM	50% OF ALL WORK
COBALT	
COPPER	
GOLD	3/YR
NICKEL	
NICKEL COBALT	
NICKEL TUNGSTEN	
PLATINUM	3/YR
SILVER	3/YR



OVEN
SUPPORT EQUIP
VAC CAB
DUST COLLECTOR
SHOT PEEN
BLAST PEEN
BLOWER
DRYER
TUMBLER
RACK
TABLE
TUMBLE BLAST
CE12
CE05
CE04
WAX TANK
WATER TANK
5685
CE02
CE01
BRUSH PLATING
CART
DESK
SINK & COUNTER
BLAST
3491
3456
CE23
SAND BLAST
5372
5373
MENS RESTROOM
WOMENS RESTROOM
SAND HOPPER
LOCKERS
BENCH
POP
COVERALL CAGE
LUNCH ROOM
MAGNAFLUX
AISLE
CE50
CE08
IVD
7460
4972
RACKS
NORTON GAP GRINDER
OVERHEAD MONORAIL
MICROMATIC VERT HONE
FILTER & SEPARATOR
STOR SHELVES

CADMIUM

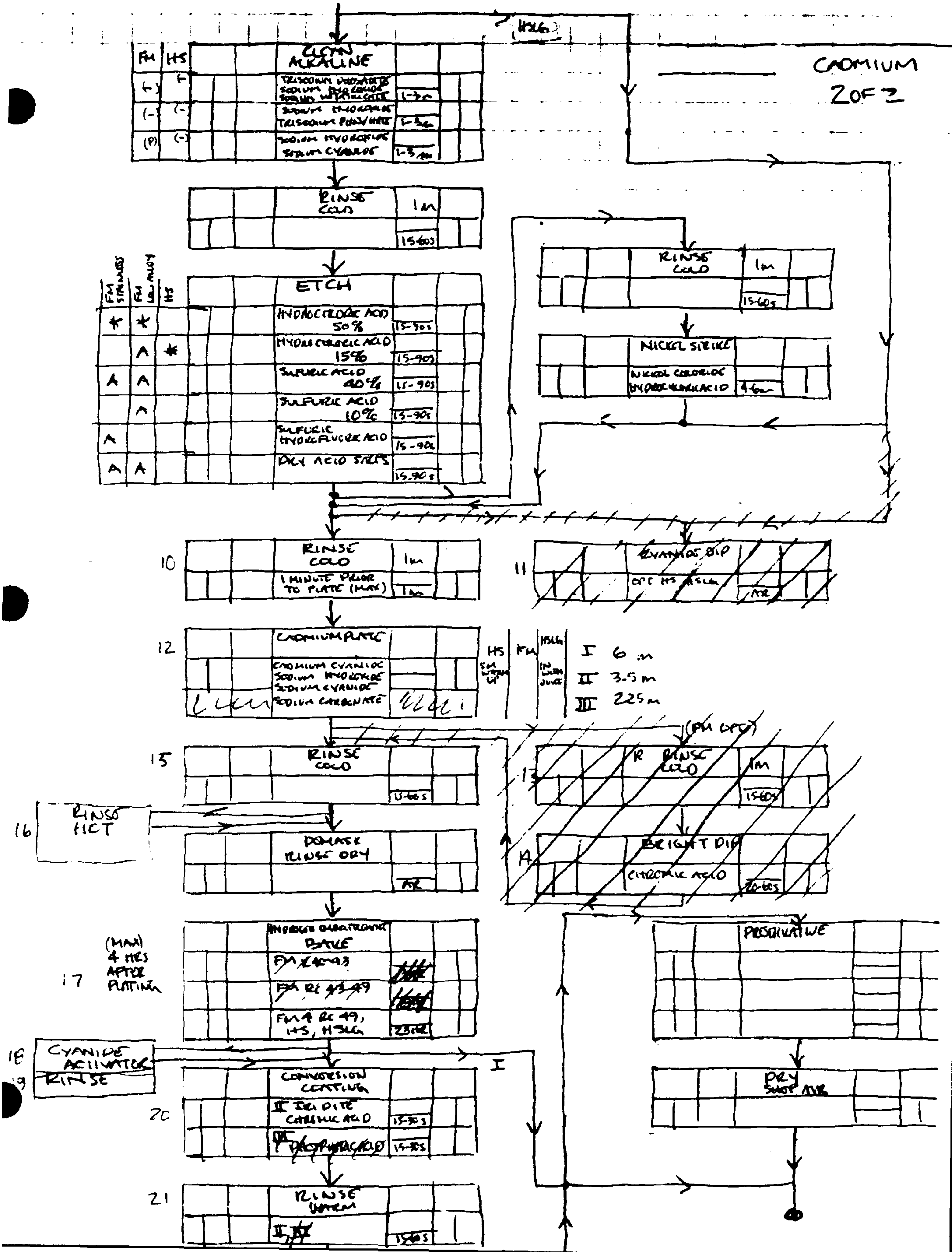
1 OF 2

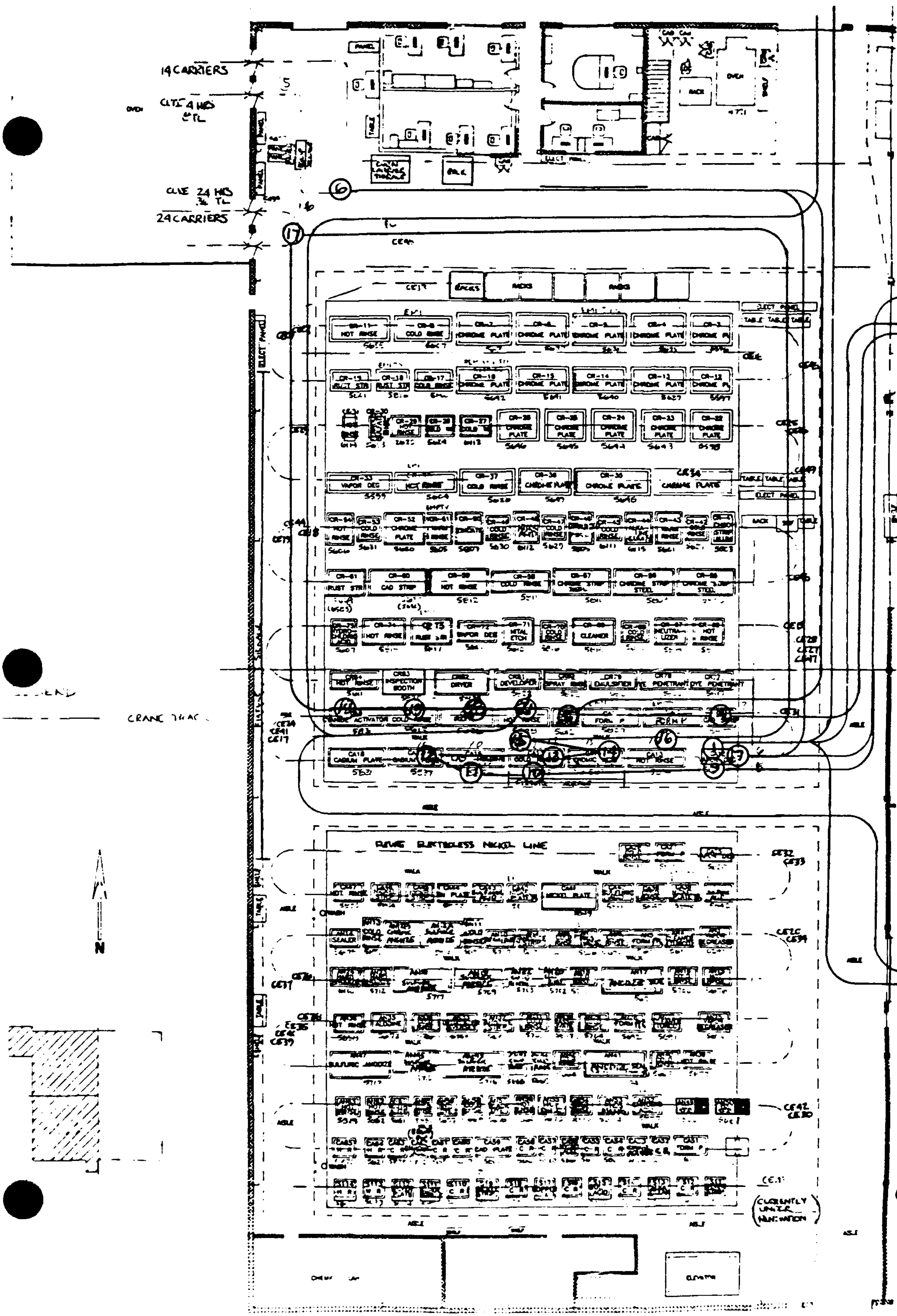


FM	FERROUS METAL NOT LANDING GEAR (↑ 180,000)
HS	HIGH STRENGTH STEEL NOT LANDING GEAR (↑ 180,000)
HSLG	HIGH STRENGTH STEEL LANDING GEAR

CADMIUM

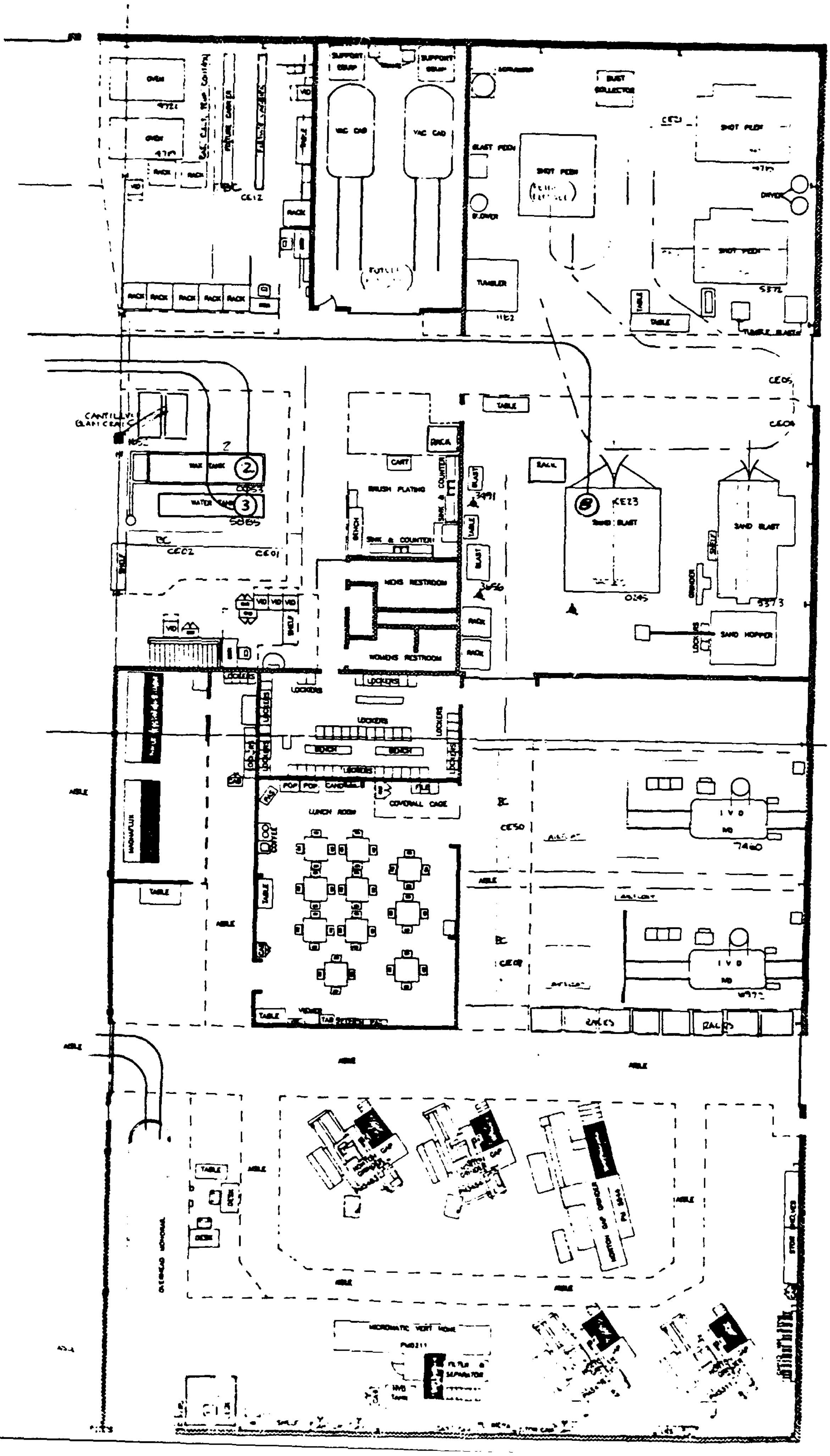
2 OF 3





CADMIUM

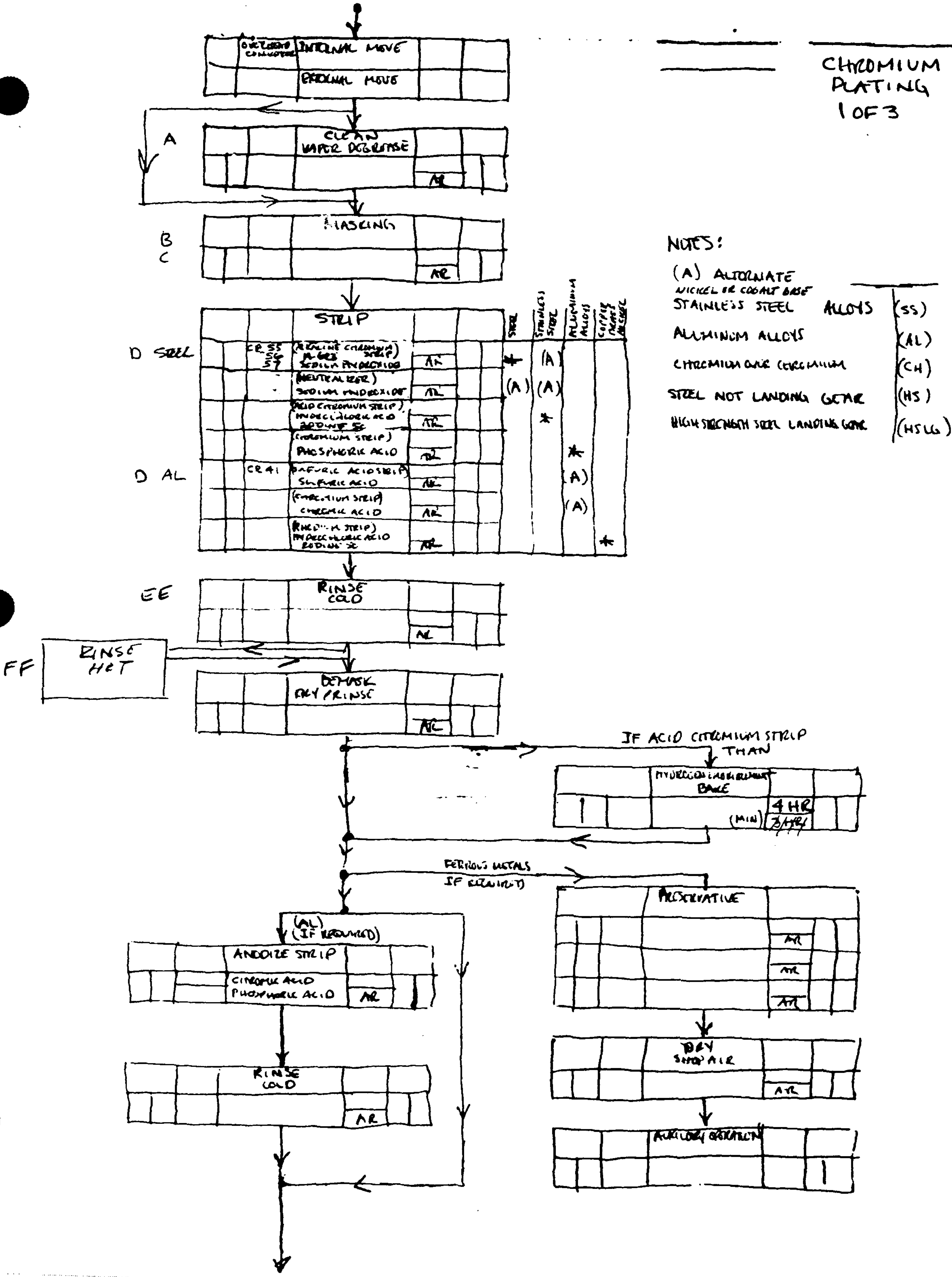
1 OF 2

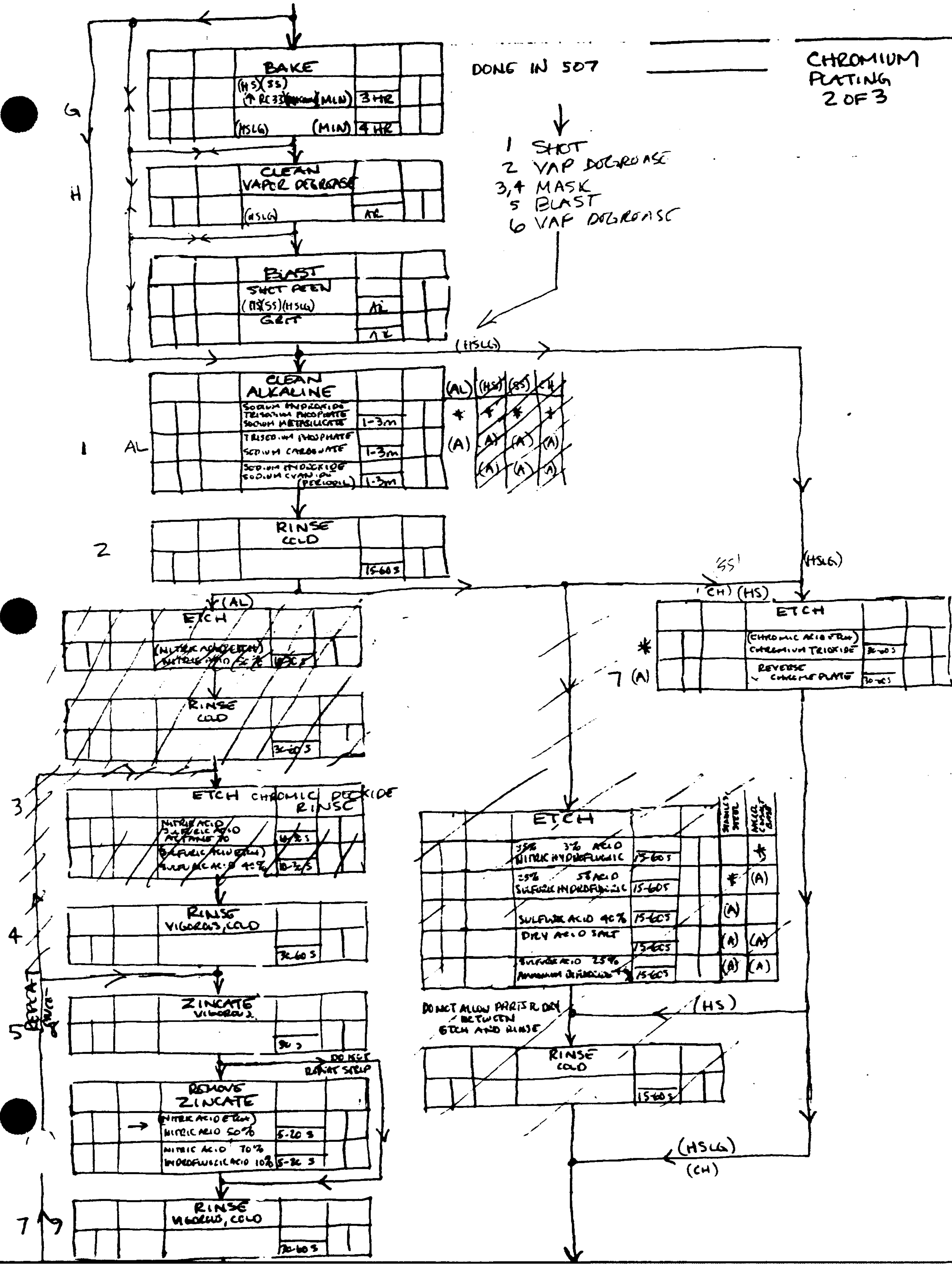


CADMIUM

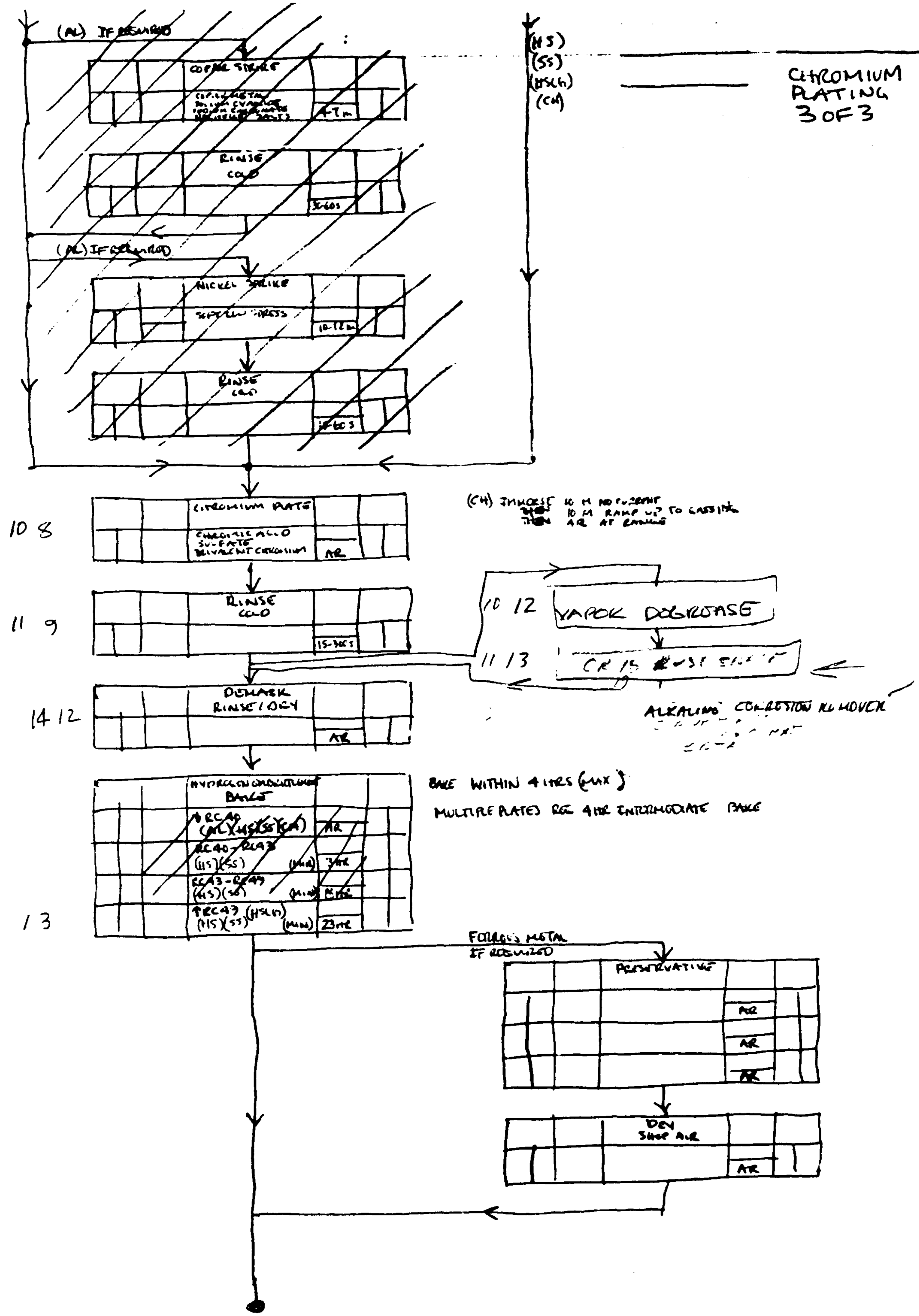
2 OF 2

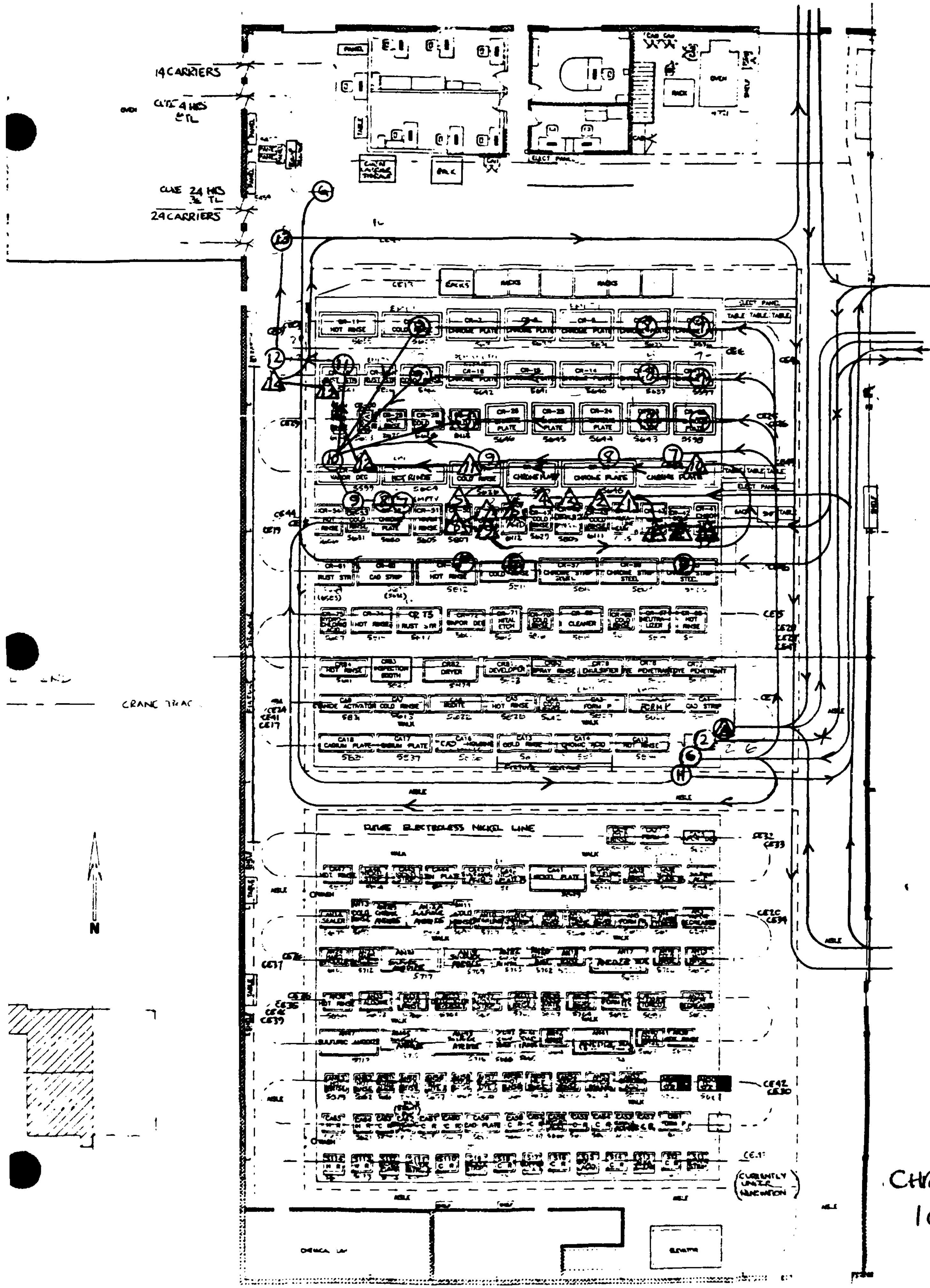
CHROMIUM PLATING



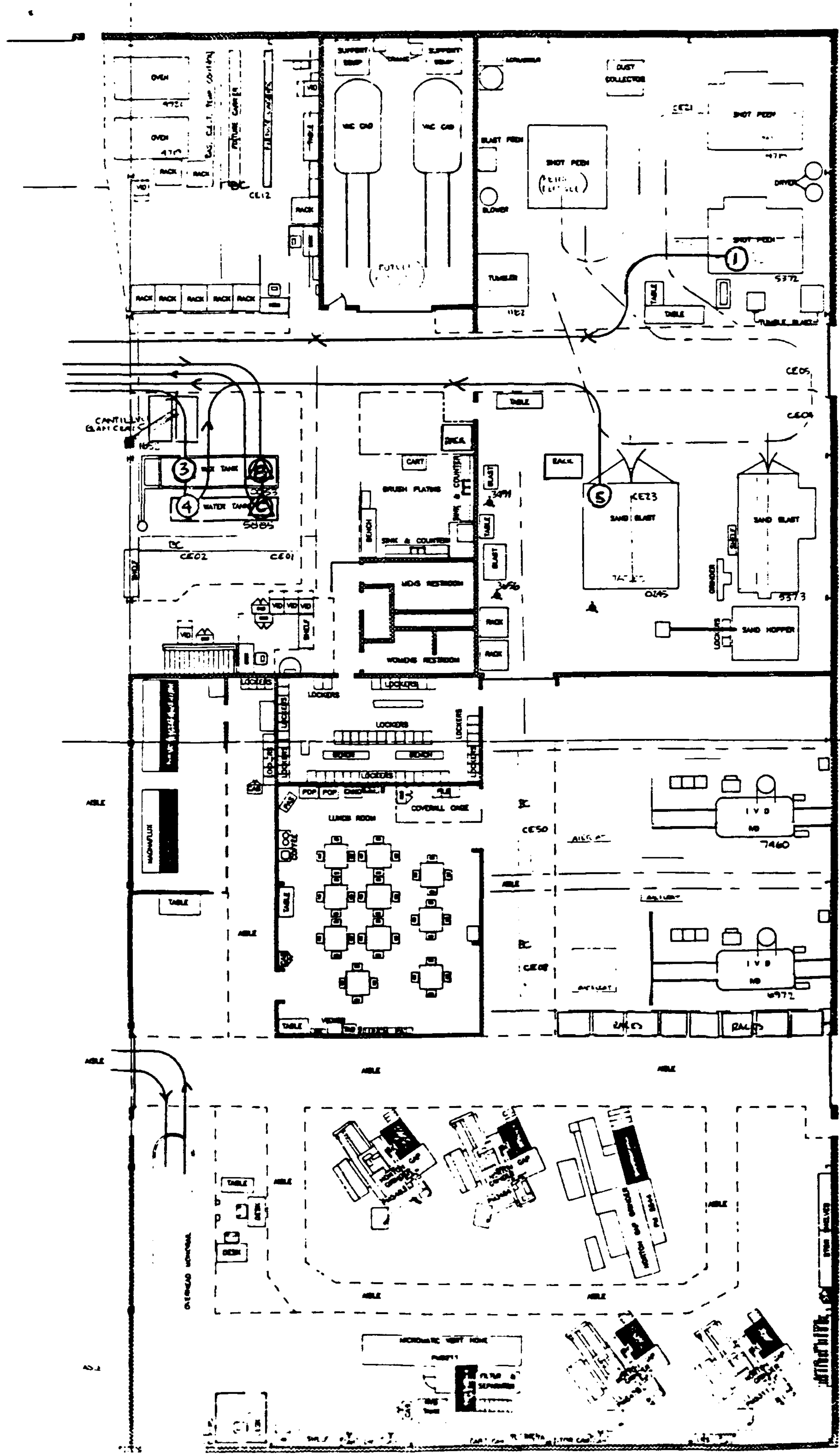

DONE IN 507
1 SHOT
2 VAP DEGREASE
3,4 MASK
5 BLAST
6 VAP DEGREASE
BAKE
(HS)(SS)
(↑ RC 33) (MIN) 3 HR
(HSLG) (MIN) 4 HR
G
H
CLEAN
VAPOR DEGREASE
(HSLG)
AR
BLAST
SHOT PEEN
(HS)(SS)(HSLG)
AL
GRIT
AL
(HSLG)
CLEAN
ALKALINE
(AL) (HS) (SS) (CH)
SODIUM HYDROXIDE
TRISODIUM PHOSPHATE
SODIUM METASILICATE
1-3m
TRISODIUM PHOSPHATE
SODIUM CARBONATE
1-3m
SODIUM HYDROXIDE
SODIUM CYANIDE
(PERIODIC)
1-3m
1
AL
*
(A)
RINSE
COLD
15-60 S
2
(AL)
ETCH
(NITRIC ACID ETCH)
NITRIC ACID 50%
RINSE
COLD
30-60 S
3
ETCH CHROMIC OXIDE
RINSE
NITRIC ACID
SULFURIC ACID
ALTANE 70
SULFURIC ACID ETCH
SULFURIC ACID 40%
10-25 S
4
RINSE
VIGOROUS, COLD
30-60 S
5
REPEAT ONCE
ZINCATE
VIGOROUS
30 S
DO NOT REPEAT STRIP
REMOVE
ZINCATE
NITRIC ACID ETCH
NITRIC ACID 50%
5-20 S
NITRIC ACID 70%
HYDROFLUORIC ACID 10%
5-30 S
7
RINSE
VIGOROUS, COLD
30-60 S
SS
(CH) (HS)
(HSLG)
ETCH
CHROMIC ACID ETCH
CHROMIUM TRIOXIDE
30-60 S
REVERSE
CHROME PLATE
30-60 S
7 (A)
ETCH
STAINLESS STEEL
NICKEL COBALT ALLOY
35% 3% ACID
NITRIC HYDROFLUORIC
15-60 S
25% 5% ACID
SULFURIC HYDROFLUORIC
15-60 S
SULFURIC ACID 40%
15-60 S
DRY ACID SALT
15-60 S
SULFURIC ACID 25%
AMMONIUM BIFLUORIDE
15-60 S
DO NOT ALLOW PARTS TO DRY
BETWEEN
ETCH AND RINSE
(HS)
RINSE
COLD
15-60 S
(HSLG)
(CH)

CHROMIUM PLATING 3 OF 3





CHROMIUM
1 OF 2



CHROMIUM
2 OF 2

DRY FILM COATING

DRY FILM COATING

SPRAY

DIP

BRUSH

COTTON SWAB

BAKE CURE

1 HR

IVD
(ION VAPOR DEPOSITION)

VAPOR DEGREASE

↓
MASK

↓
BLAST

↓
DEMASK

↓
CLEAN

↓
MASK

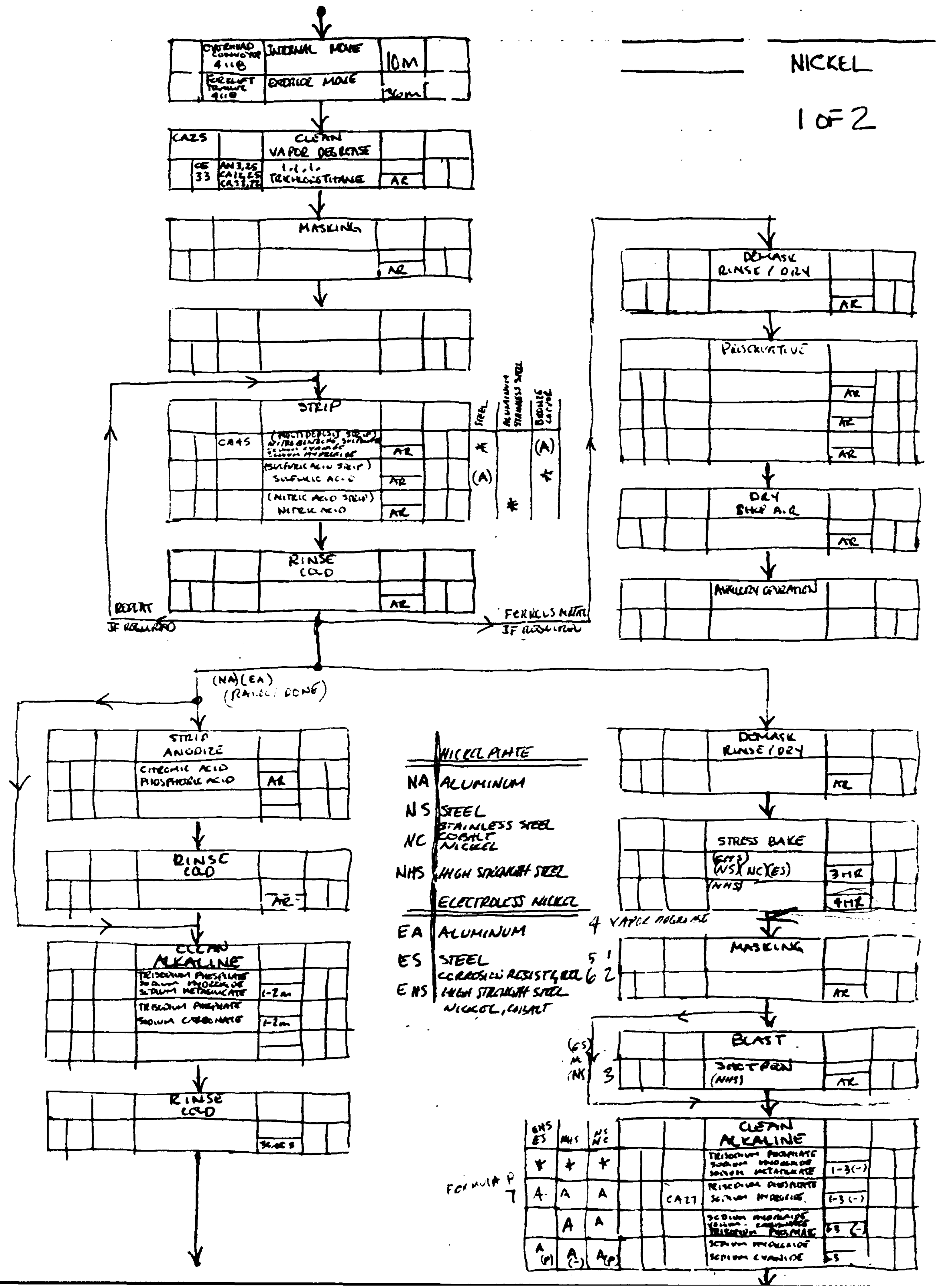
↓
IVD 45-65 MINUTES

↓
DEMASK

↓
? CONVERSION COAT ?

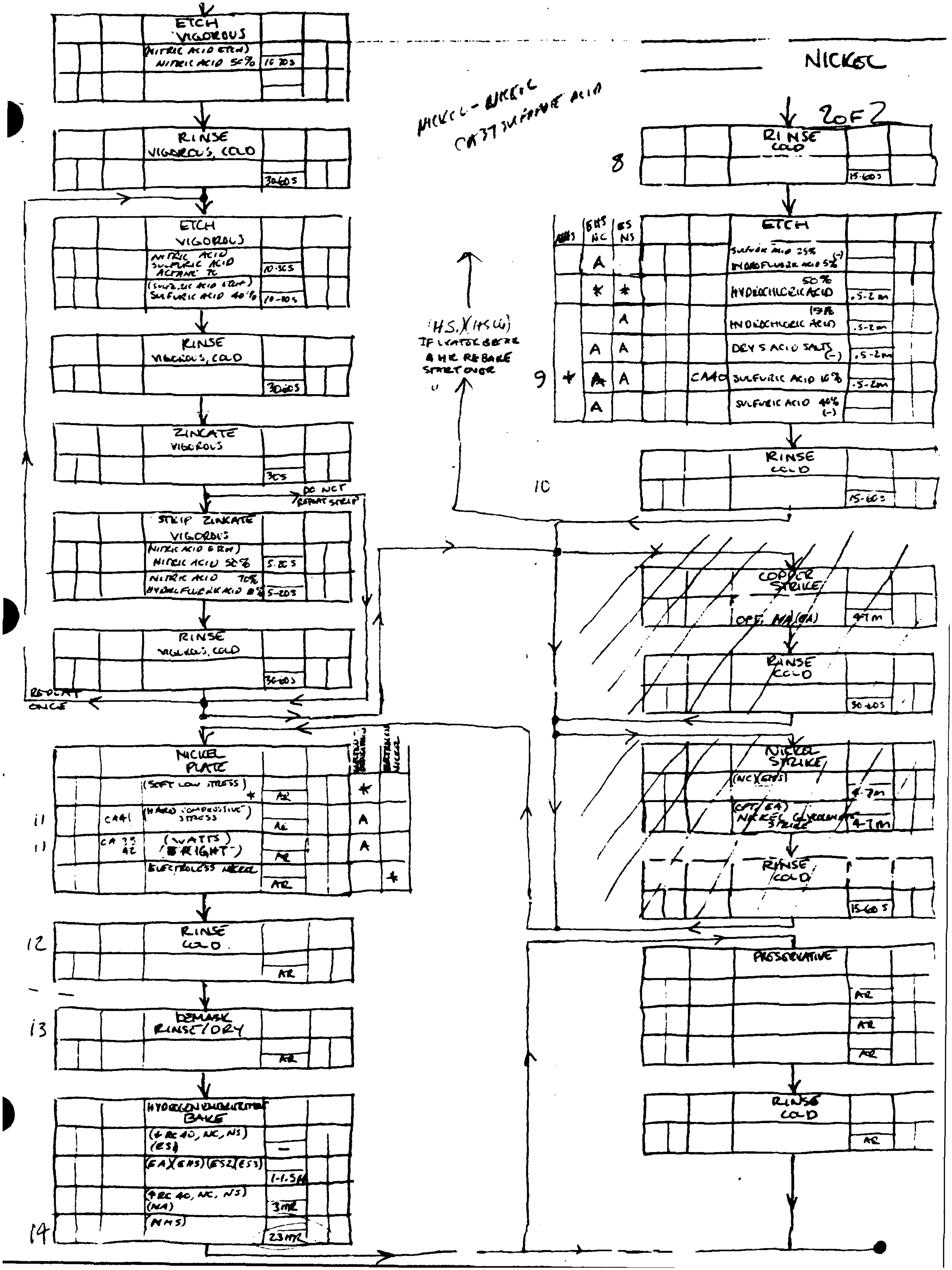
↓
ALODINE

↓
RINSE
WARM

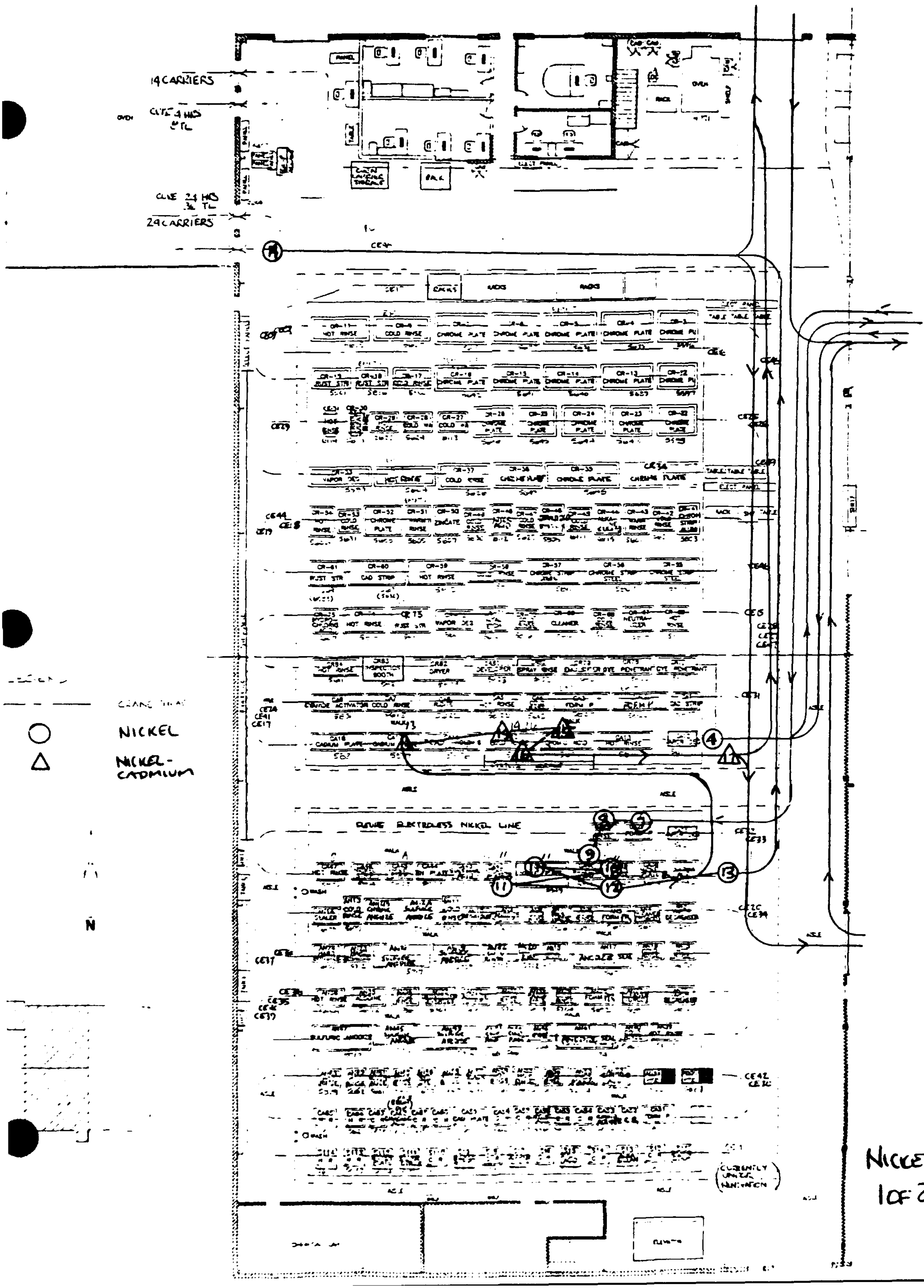

OVERHEAD CONVEYOR 4110
INTERNAL MOVE
10M
FORKLIFT TRAILER 4110
EXTERIOR MOVE
30M
CA25
CLEAN
VAPOR DEGREASE
CE 33
AN3,25 CA12,25 CA13,72
1,1,1, TRICHLOROETHANE
AR
MASKING
AR
STRIP
CA45
(MULTIDEPOSIT STRIP)
SULFURIC ACID STRIP
SULFURIC ACID
(NITRIC ACID STRIP)
NITRIC ACID
STEEL
ALUMINUM STAINLESS STEEL
BRONZE COPPER
(A)
RINSE COLD
REPLAT IF REQUIRED
FERROUS METAL IF REQUIRED
DEMASK RINSE / DRY
PRESERVATIVE
DRY SHOP AIR
AUXILIARY OPERATION
(NA)(EA) (RANGE DONE)
STRIP ANODIZE
CITRIC ACID
PHOSPHORIC ACID
RINSE COLD
CLEAN ALKALINE
TRISODIUM PHOSPHATE
SODIUM HYDROXIDE
SODIUM METASILICATE
1-2m
TRISODIUM PHOSPHATE
SODIUM CARBONATE
1-2m
RINSE COLD
NICKEL PLATE
NA ALUMINUM
NS STEEL
NC STAINLESS STEEL COBALT NICKEL
NHS HIGH STRENGTH STEEL
ELECTROLESS NICKEL
EA ALUMINUM
ES STEEL
CORROSION RESISTANT STEEL
EHS HIGH STRENGTH STEEL
NICKEL, COBALT
4 VAPOR DEGREASE
5 1
6 2
DEMASK RINSE / DRY
STRESS BAKE
(EHS) (NS)(NC)(ES)
(NHS)
3HR
4HR
MASKING
BLAST
(ES) (NS)
3
SHOT PEEN (NHS)
EHS ES
NHS
NS NC
CLEAN ALKALINE
TRISODIUM PHOSPHATE
SODIUM HYDROXIDE
SODIUM METASILICATE
1-3(-)
FORMULA P 7
TRISODIUM PHOSPHATE
CA27
SODIUM HYDROXIDE
1-3(-)
SODIUM PHOSPHATE
TRISODIUM PHOSPHATE
SODIUM HYDROXIDE
SODIUM CYANIDE

NICKEL

2 OF 2

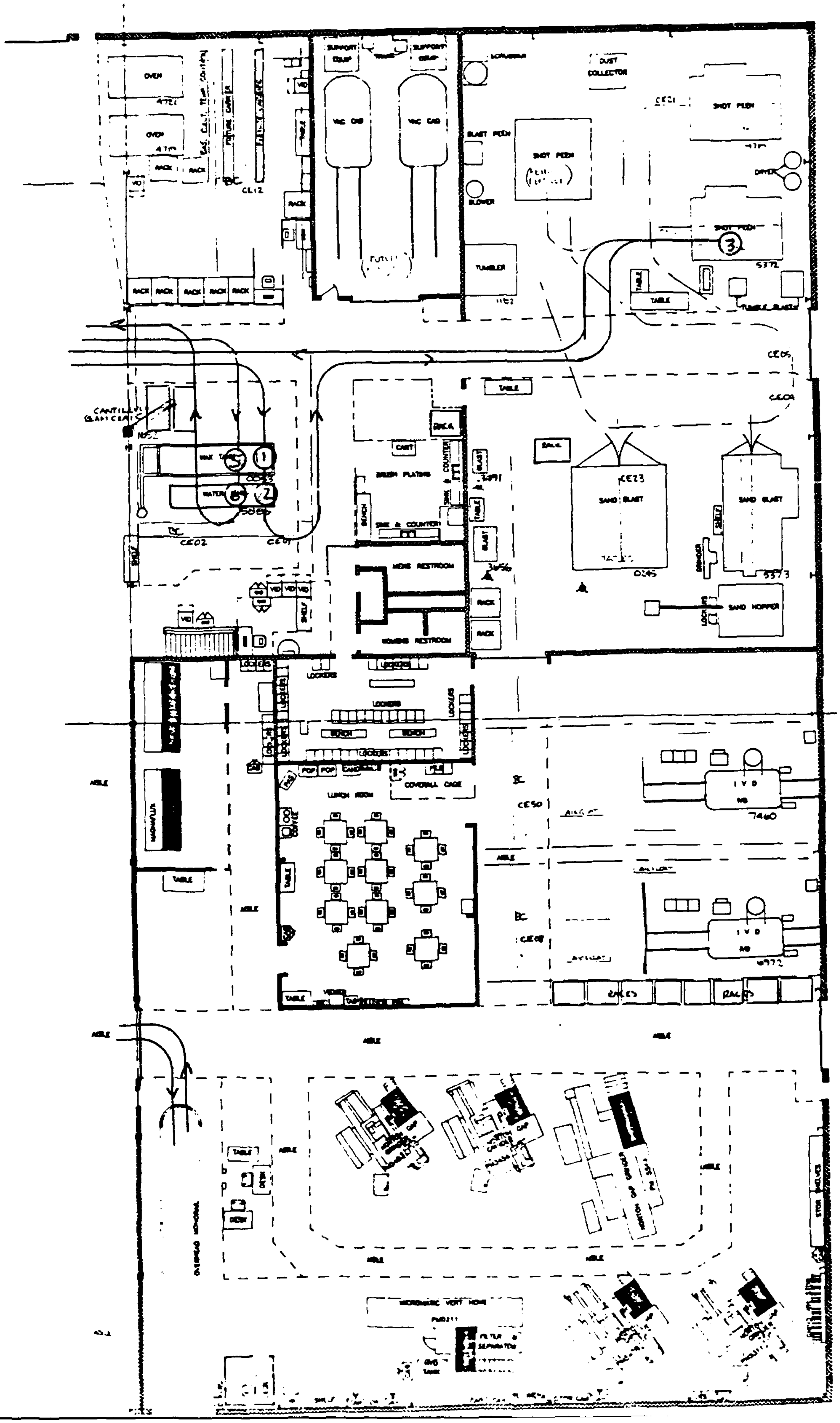


NICKEL - NICKEL
CA37 SULFAMATE ACID
ETCH
VIGOROUS
(NITRIC ACID ETCH)
NITRIC ACID 50%
10-30S
RINSE
VIGOROUS, COLD
30-60S
ETCH
VIGOROUS
NITRIC ACID
SULFURIC ACID
ACTANE 70
10-30S
(SULFURIC ACID ETCH)
SULFURIC ACID 40%
10-30S
RINSE
VIGOROUS, COLD
30-60S
ZINCATE
VIGOROUS
30S
DO NOT REPEAT STRIP
STRIP ZINCATE
VIGOROUS
(NITRIC ACID ETCH)
NITRIC ACID 50%
5-20S
NITRIC ACID 70%
HYDROFLUORIC ACID 8%
5-20S
RINSE
VIGOROUS, COLD
30-60S
REPEAT ONCE
NICKEL PLATE
(SOFT LOW STRESS)
AR
11 CA41 (HARD COMPRESSIVE STRESS)
AR
11 CA35 A2 (WATTS) (BRIGHT)
AR
ELECTROLESS NICKEL
AR
12 RINSE COLD
AR
13 DEMASK RINSE/DRY
AR
HYDROGEN EMBRITTLEMENT BAKE
(4RC40, NC, NS) (ES)
(EA)(EHS)(ES2)(ES3)
1-1.5HR
(4RC40, NC, NS) (NA)
3HR
(NHS)
14 23HR
HS (HSW)
IF WATER BREAK 4 HR REBAKE START OVER
8 RINSE COLD
15-60S
ETCH
EHS NC
ES NS
SULFURIC ACID 25% HYDROFLUORIC ACID 5% (-)
50% HYDROCHLORIC ACID
.5-2m
15% HYDROCHLORIC ACID
.5-2m
DRY S ACID SALTS (-)
.5-2m
9 CA40 SULFURIC ACID 16%
.5-2m
SULFURIC ACID 40% (-)
10 RINSE COLD
15-60S
COPPER STRIKE
OPT. NA (EA)
4-7m
RINSE COLD
30-60S
NICKEL STRIKE
(NC)(EHS)
4-7m
(OPT/EA) NICKEL GLYCOLATE STRIKE
4-7M
RINSE COLD
15-60S
PRESERVATIVE
AR
AR
AR
RINSE COLD
AR



14 CARRIERS
CLVE 4 HRS
CLVE 24 HRS
24 CARRIERS
CHROME PLATE
HOT RINSE
COLD RINSE
VAPOR DEG
CHROME STRIP STEEL
CLEANER
INSPECTION BOOTH
DRYER
DEVELOPER
SPRAY RINSE
PENETRANT
CADMIUM PLATE
FUTURE ELECTROLESS NICKEL LINE
SULFURIC ANODIZE
NICKEL
NICKEL-CADMIUM
CURRENTLY UNDER RENOVATION

NICKEL
1 OF 2



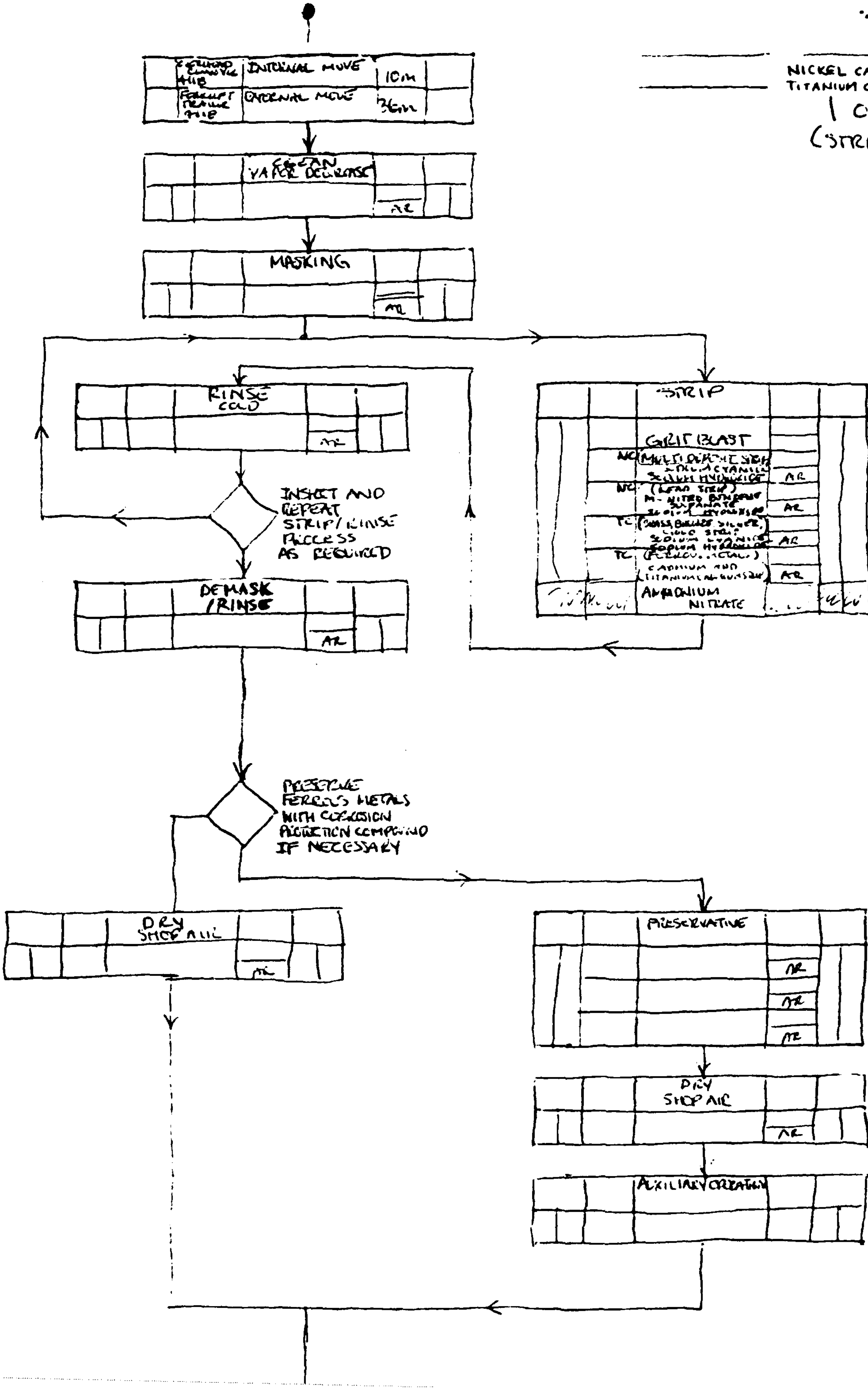
OVEN
OVEN
RACK
SUPPORT EQUIP
VAC CAB
VAC CAB
DUST COLLECTOR
SHOT PEEN
BLAST PEEN
BLOWER
TUMBLER
DRYER
TABLE
TUMBLE BLAST
SAND BLAST
SAND BLAST
SAND HOPPER
WAX TANK
WATER
BRUSH PLATING
SINK & COUNTER
MENS RESTROOM
WOMENS RESTROOM
LOCKERS
BENCH
LUNCH ROOM
COVERALL CAGE
POP
MAGNAFLUX
AISLE
I V D
RACKS
OVERHEAD MONORAIL
MICROMATIC VERT HONE
FILTER & SEPARATOR
STOR SHELVES
NORTON GAP GRINDER

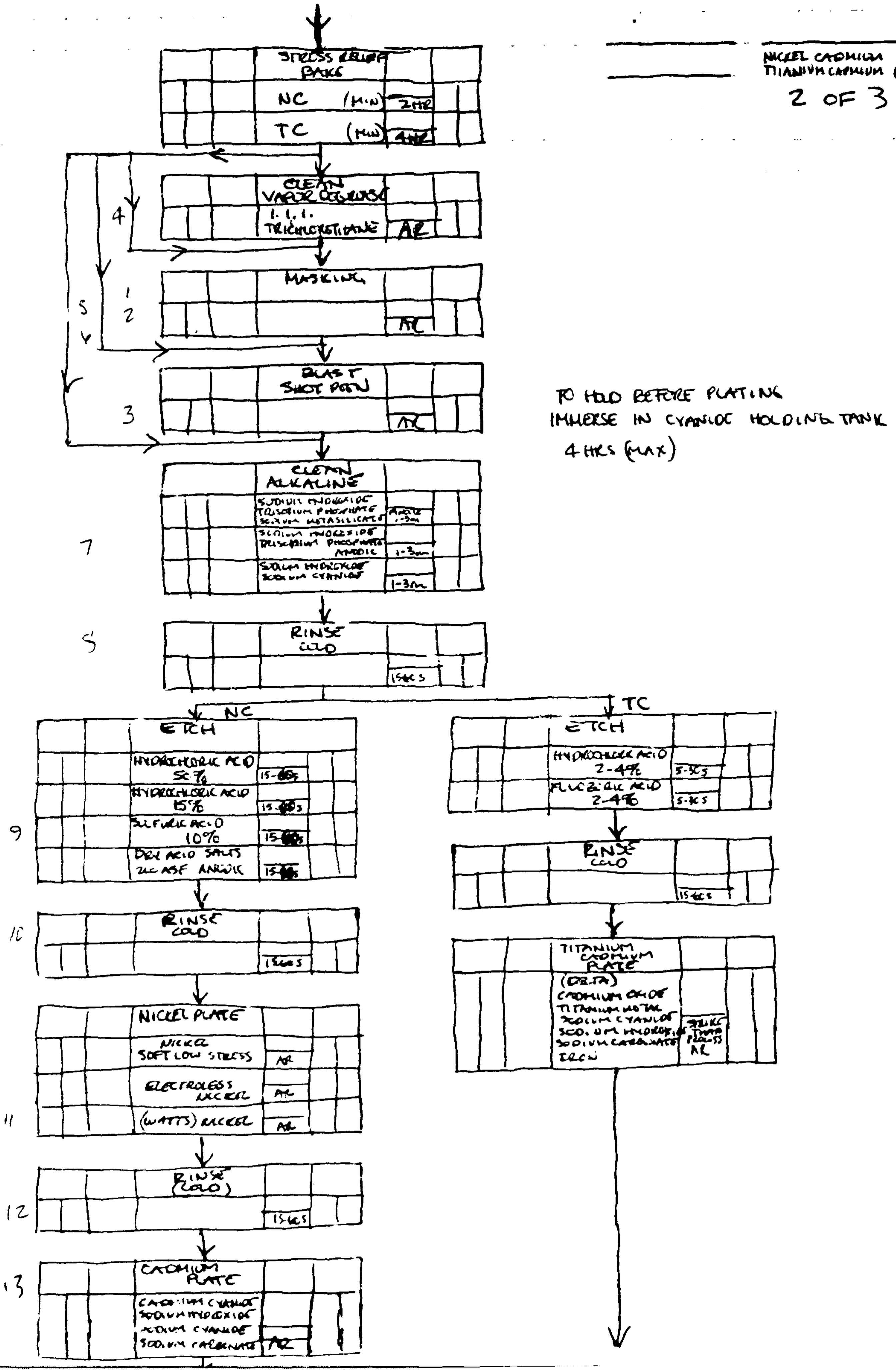
NICKEL

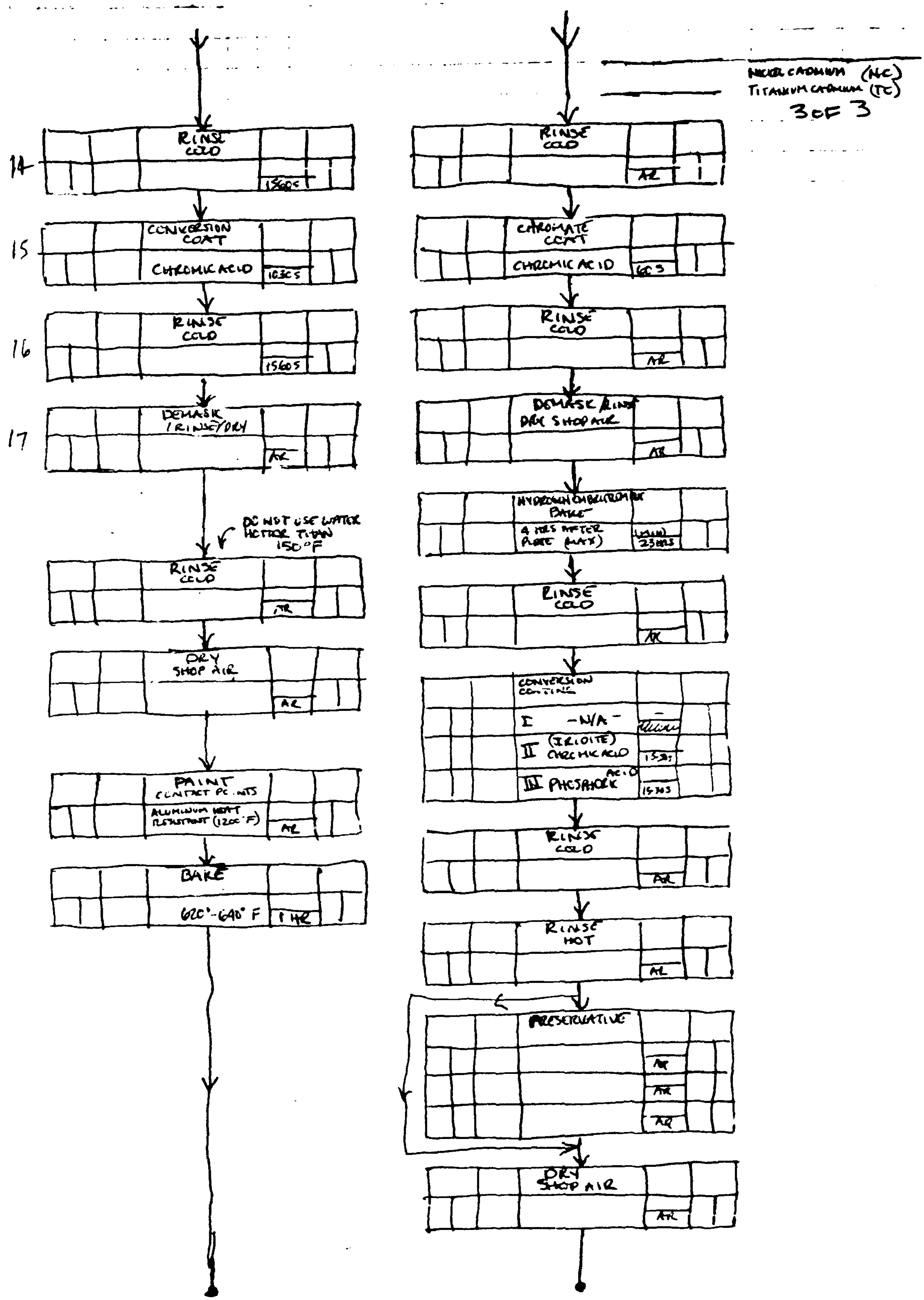
2 OF 2

NICKEL CADMIUM (NC)
TITANIUM CADMIUM (TC)

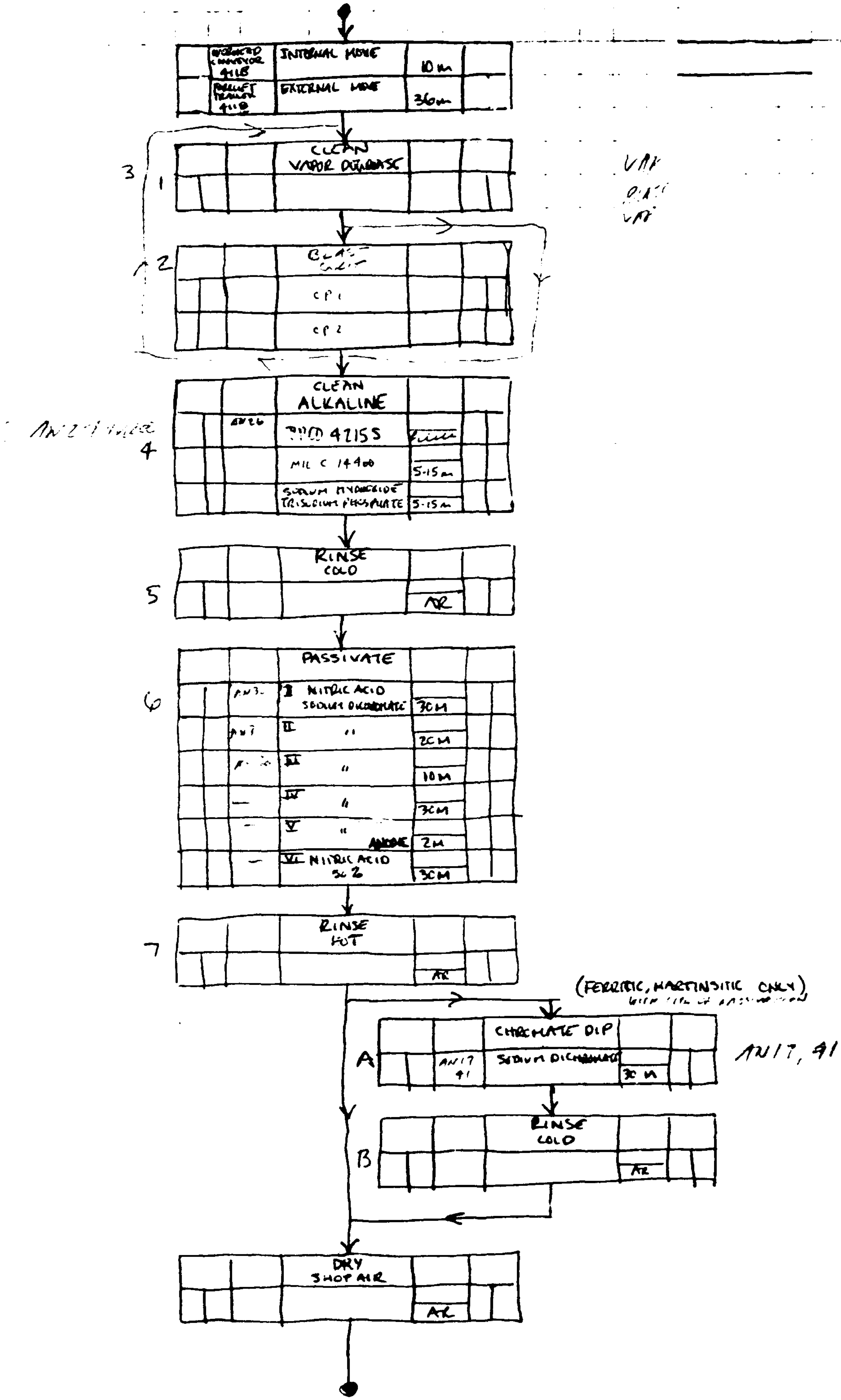
1 OF 3
(STRIP)

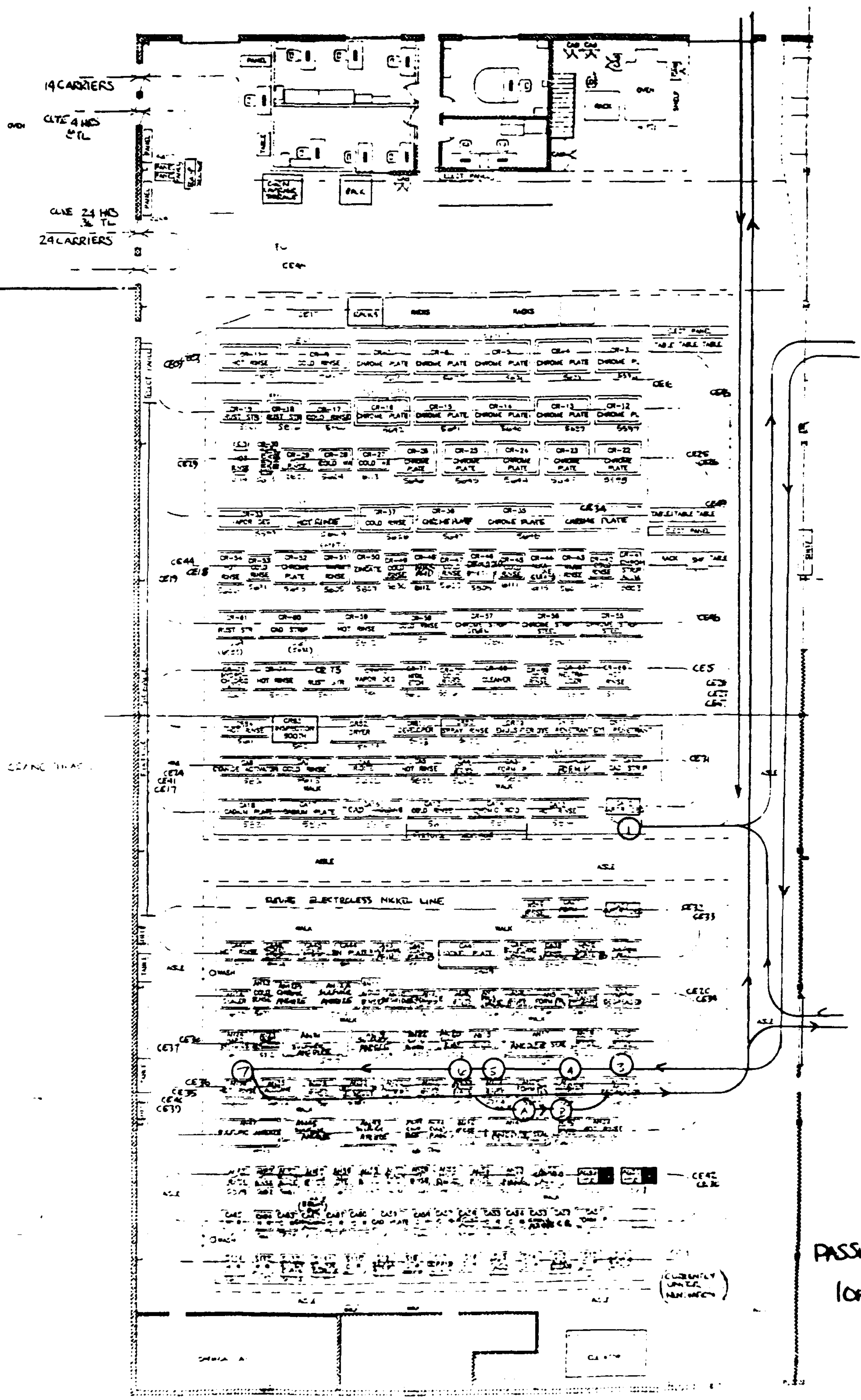



STRESS RELIEF BAKE
NC (MIN) 2HR
TC (MIN) 4HR
4
CLEAN VAPOR DEGREASE
1.1.1. TRICHLOROETHANE AR
1
2
5
MASKING
AR
BLAST SHOT PEEN
3
AR
TO HOLD BEFORE PLATING IMMERSE IN CYANIDE HOLDING TANK 4 HRS (MAX)
7
CLEAN ALKALINE
SODIUM HYDROXIDE TRISODIUM PHOSPHATE SODIUM METASILICATE
ANODIC 1-3m
SODIUM HYDROXIDE TRISODIUM PHOSPHATE ANODIC
1-3m
SODIUM HYDROXIDE SODIUM CYANIDE
1-3m
5
RINSE COLD
15 SECS
NC
TC
9
ETCH
HYDROCHLORIC ACID 50%
15-60s
HYDROCHLORIC ACID 15%
15-60s
SULFURIC ACID 10%
15-60s
DRY ACID SALTS 200 ASF ANODIC
15-60s
ETCH
HYDROCHLORIC ACID 2-4%
5-30s
FLUOBORIC ACID 2-4%
5-30s
10
RINSE COLD
15 SECS
RINSE COLD
15 SECS
NICKEL PLATE
NICKEL SOFT LOW STRESS
AR
ELECTROLESS NICKEL
AR
11
(WATTS) NICKEL
AR
TITANIUM CADMIUM PLATE
(DELTA)
CADMIUM OXIDE
TITANIUM METAL
SODIUM CYANIDE
SODIUM HYDROXIDE
SODIUM CARBONATE
IRON
STRIKE THEN PROCESS AR
12
RINSE (COLD)
15 SECS
13
CADMIUM PLATE
CADMIUM CYANIDE
SODIUM HYDROXIDE
SODIUM CYANIDE
SODIUM CARBONATE
AR



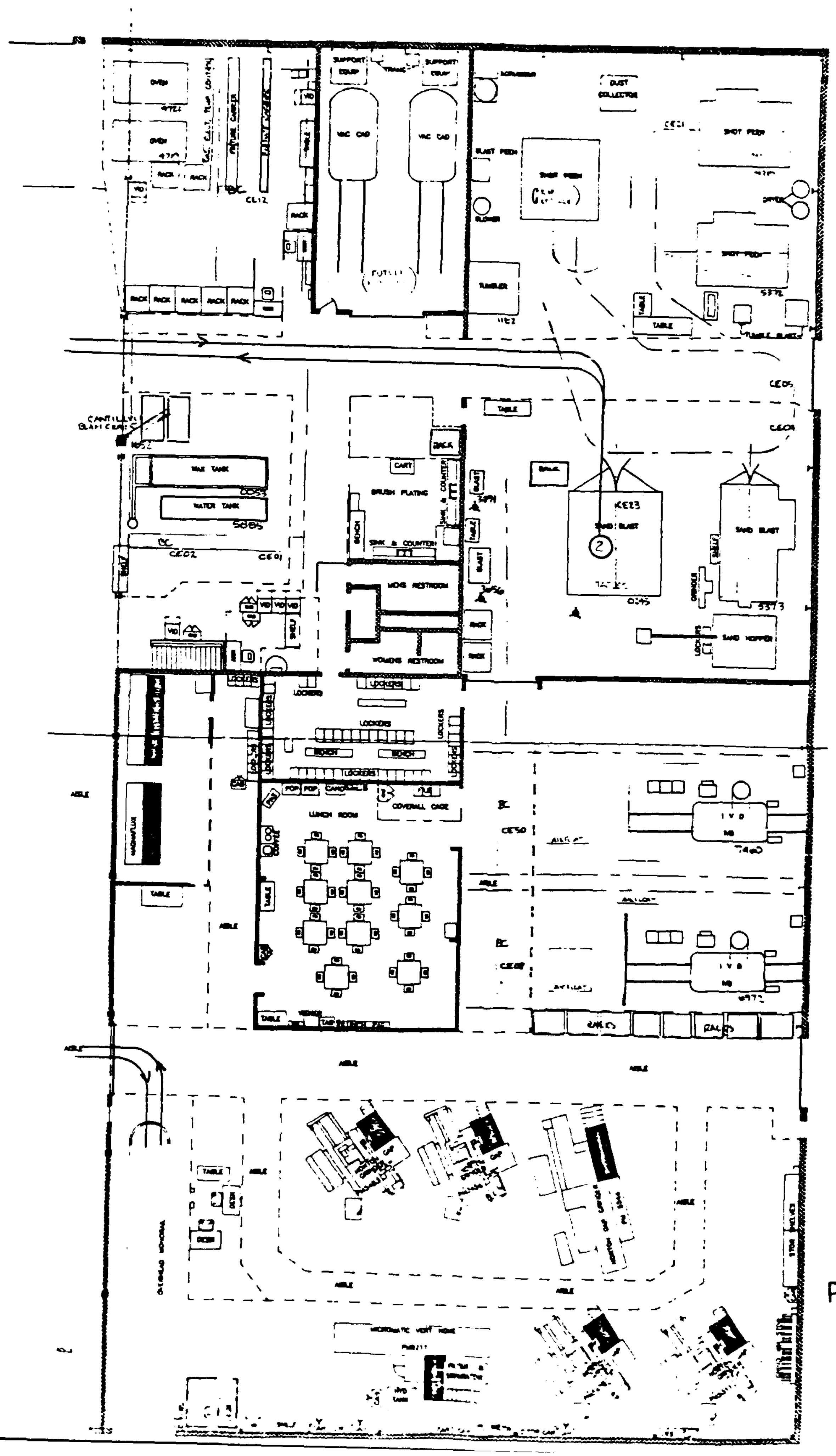
NICKEL CADMIUM (NC)
TITANIUM CADMIUM (TC)
14
RINSE COLD
15 SECS
15
CONVERSION COAT
CHROMIC ACID
10-30 S
16
RINSE COLD
15-60 S
17
DEMASK / RINSE / DRY
AR
DO NOT USE WATER HOTTER THAN 150°F
RINSE COLD
AR
DRY SHOP AIR
AR
PAINT CONTACT POINTS
ALUMINUM HEAT RESISTANT (1200°F)
AR
BAKE
620°-640° F
1 HR
RINSE COLD
AR
CHROMATE COAT
CHROMIC ACID
6 S
RINSE COLD
AR
DEMASK RINSE DRY SHOP AIR
AR
HYDROGEN EMBRITTLEMENT BAKE
4 HRS AFTER PLATE (MAX)
(MIN) 23 HRS
RINSE COLD
AR
CONVERSION COATING
I -N/A-
II (IRIDITE) CHROMIC ACID
15-30 S
III PHOSPHORIC ACID
15-30 S
RINSE COLD
AR
RINSE HOT
AR
PRESERVATIVE
AR
AR
AR
DRY SHOP AIR
AR


INTERNAL MOVE
10 m
EXTERNAL MOVE
36 m
3
1
CLEAN
VAPOR DEGREASE
2
BLAST
CP 1
CP 2
4
CLEAN
ALKALINE
MIL C 14460
5-15 m
SODIUM HYDROXIDE
TRISODIUM PHOSPHATE
5-15 m
5
RINSE
COLD
AR
6
PASSIVATE
I NITRIC ACID
SODIUM DICHROMATE
30 M
II
20 M
III
10 M
IV
30 M
V
ANODE
2 M
VI NITRIC ACID
30 M
7
RINSE
HOT
AR
(FERRITIC, MARTINSITIC ONLY)
A
CHROMATE DIP
SODIUM DICHROMATE
30 M
ANI7, 41
B
RINSE
COLD
AR
DRY
SHOP AIR
AR



PASSIVATION

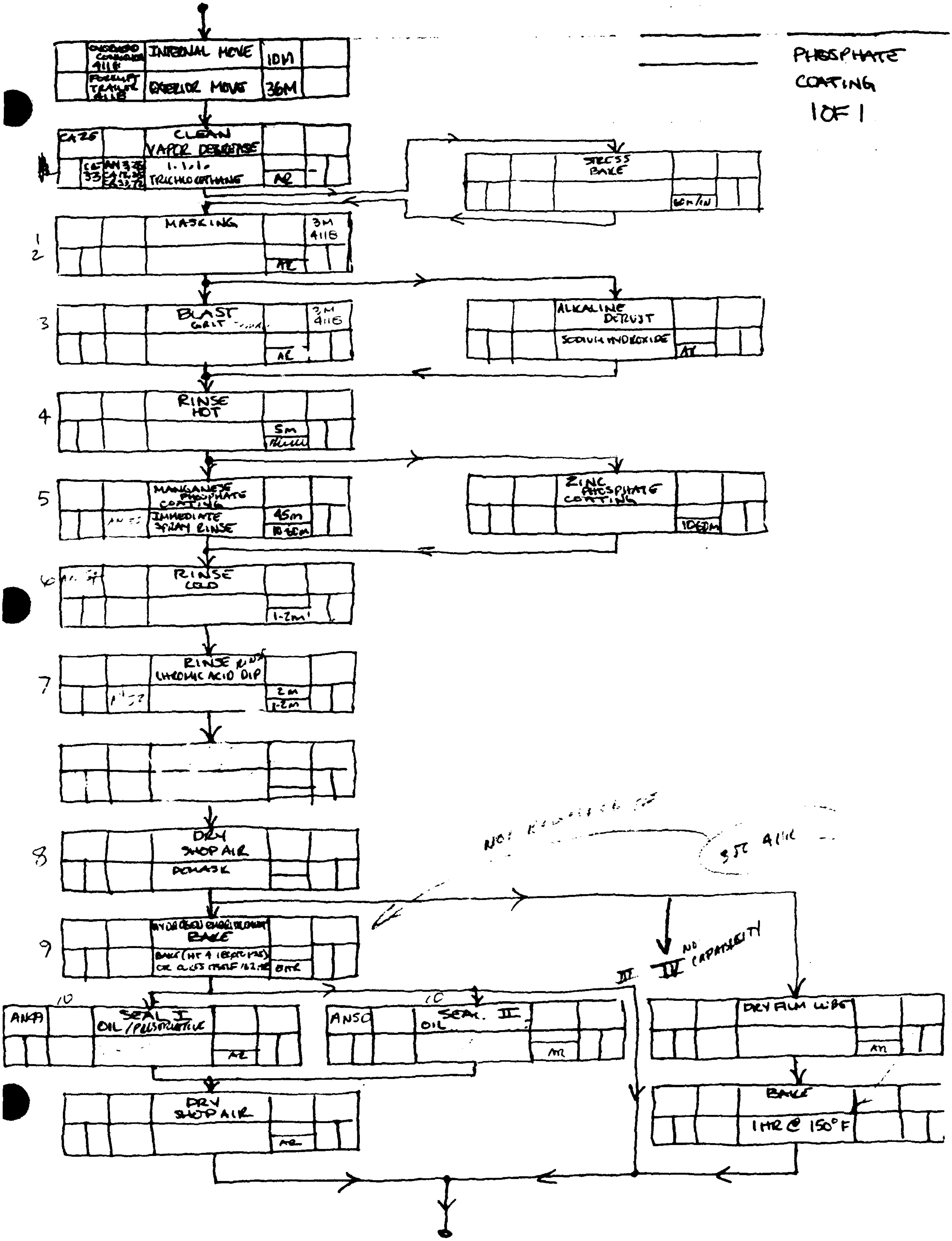
1 OF 2

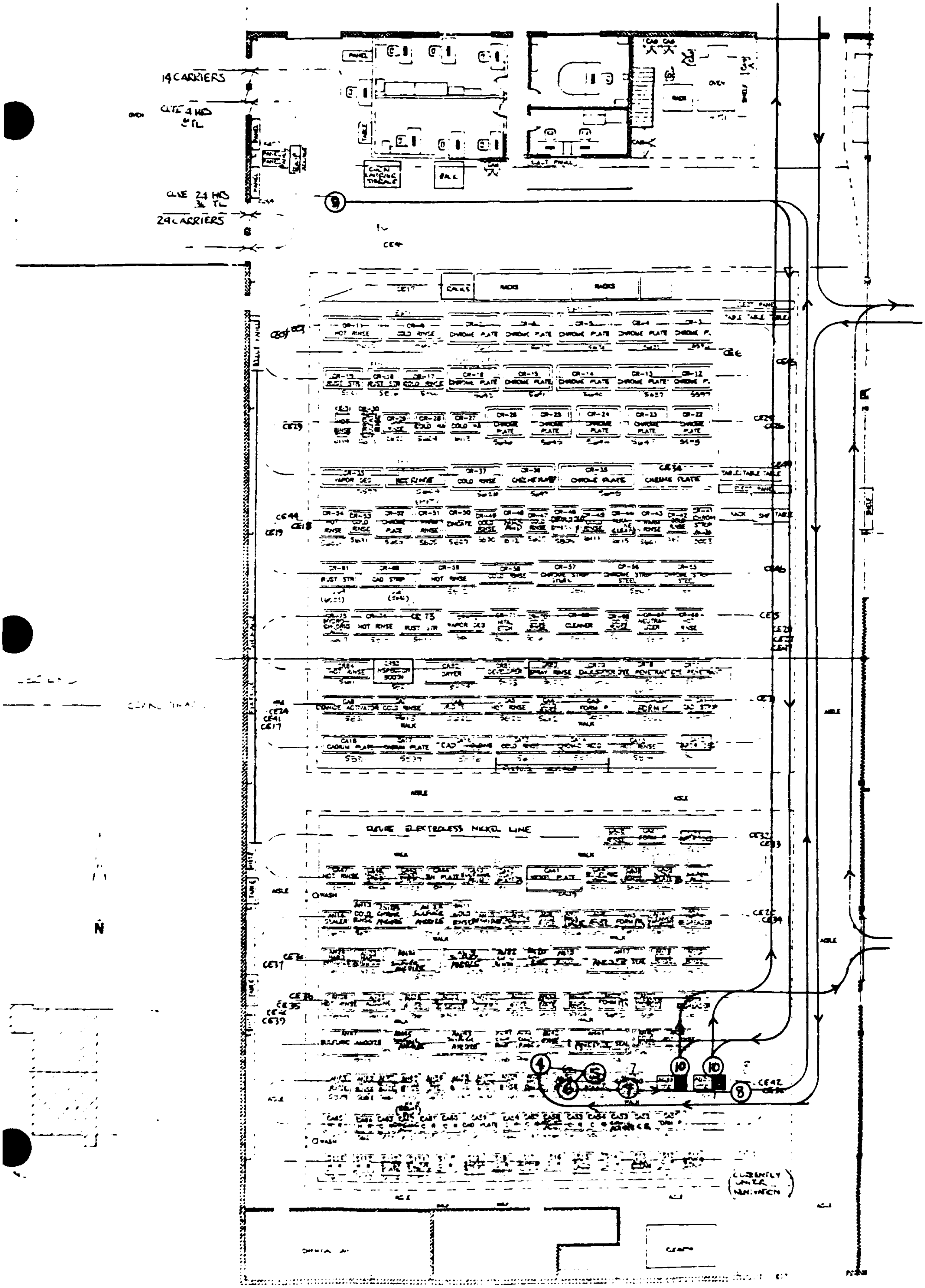


PASSIVATION

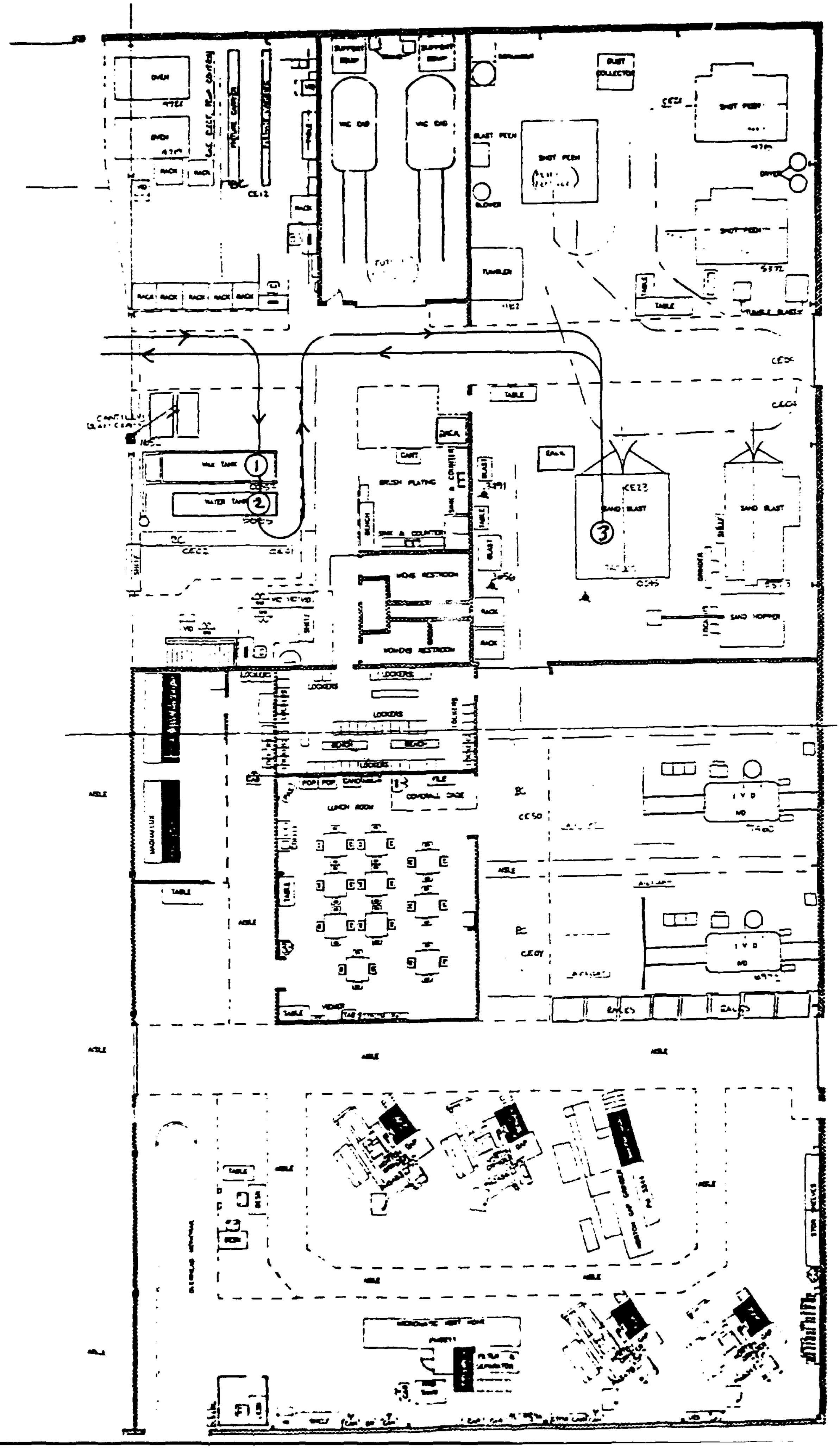
2OF2

PHOSPHATE COATING
1 OF 1

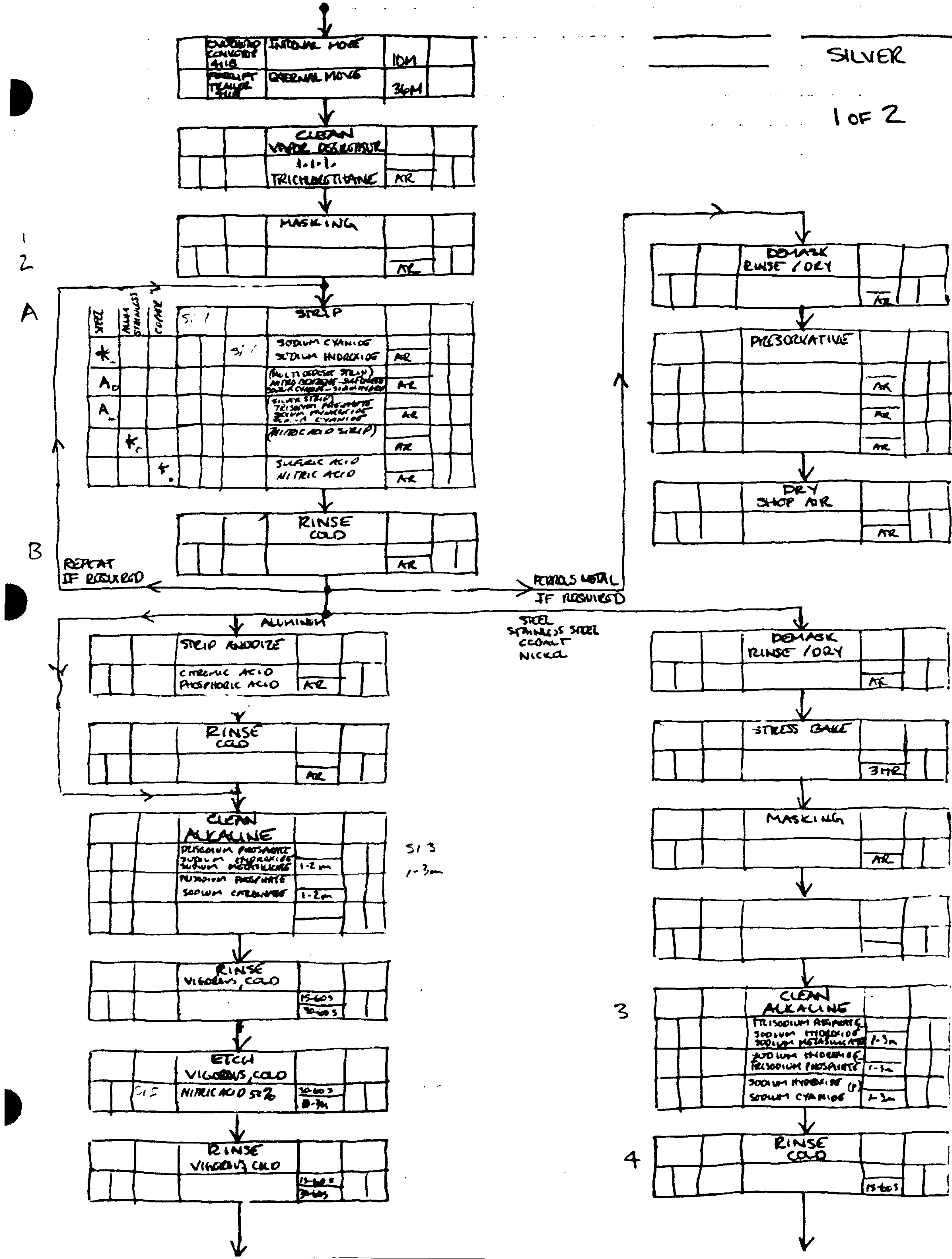


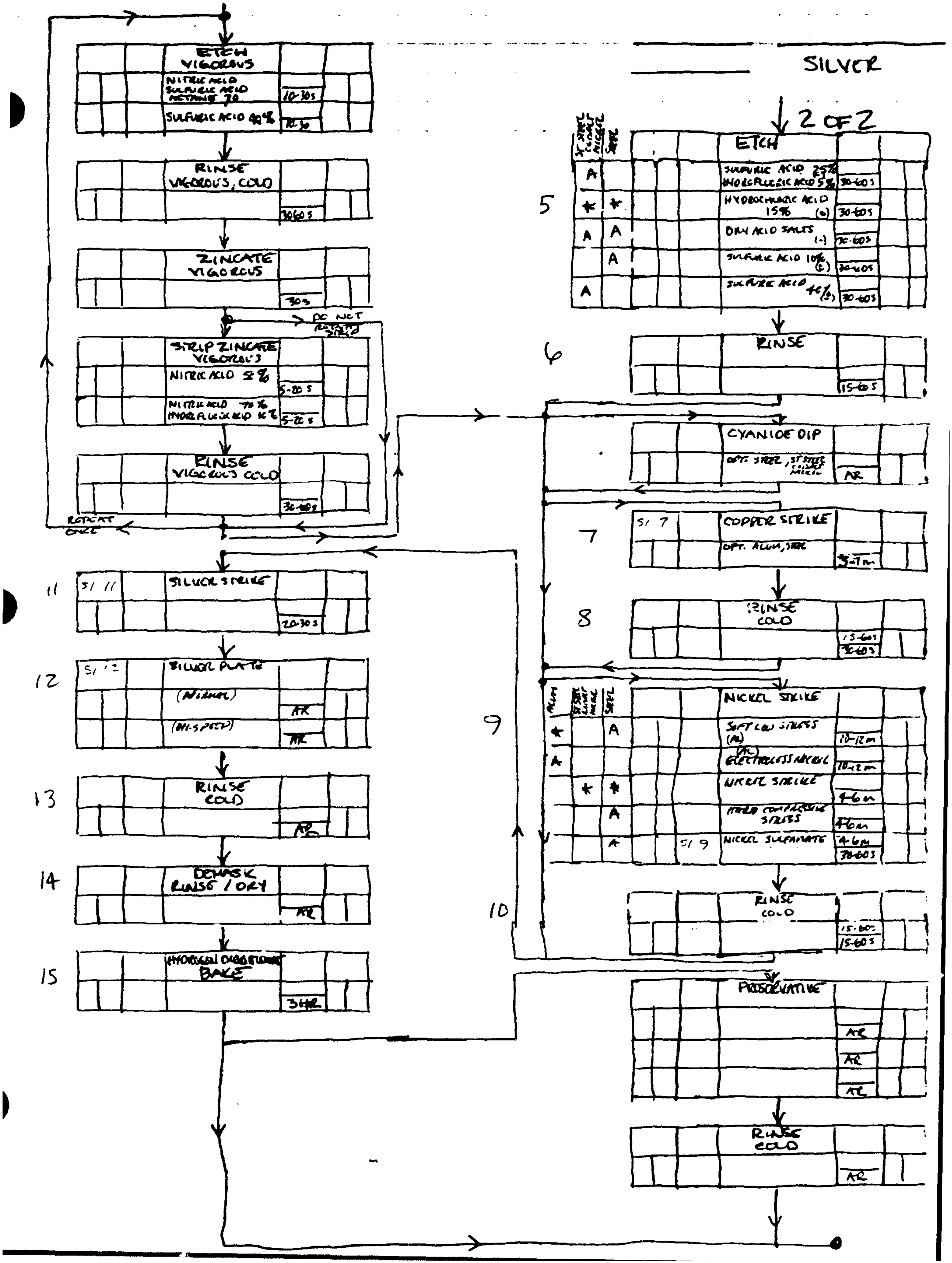


14 CARRIERS
24 CARRIERS
CHROME PLATE
HOT RINSE
COLD RINSE
RUST STR
VAPOR DEG
CLEANER
DRYER
CADMIUM PLATE
FUTURE ELECTROLESS NICKEL LINE
NICKEL PLATE
SULFURIC ANODIZE
AISLE
WALK
WASH
N
CURRENTLY UNDER RENOVATION

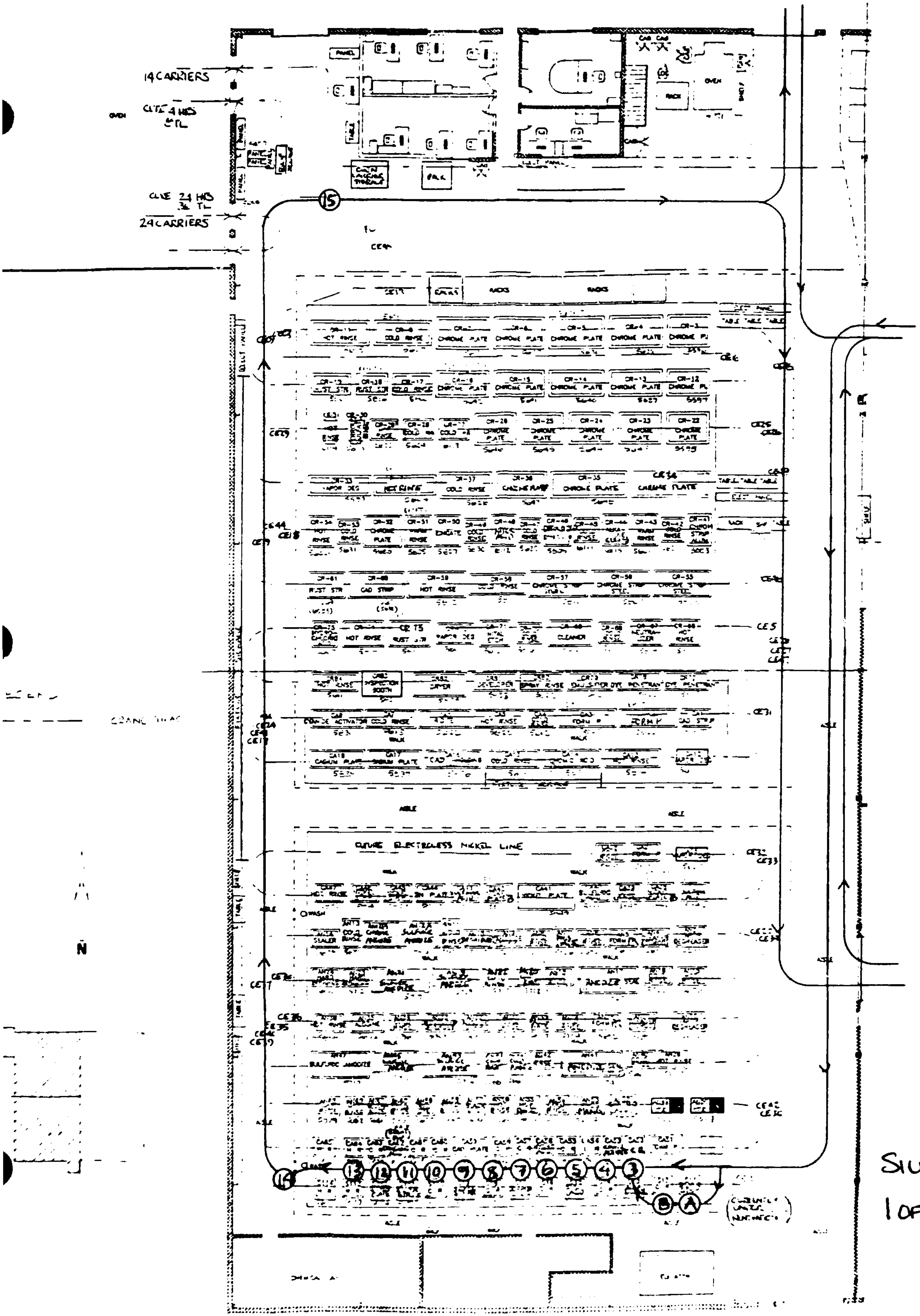


OVEN
OVEN
RACK
VAC CAB
VAC CAB
TABLE
SHOT PEEN
DUST COLLECTOR
BLAST PEEN
BLOWER
TUMBLER
DRYER
TABLE
TUMBLE BLASTS
WAX TANK
WATER TANK
BRUSH PLATING
CART
SINK & COUNTER
BENCH
SAND BLAST
SAND BLAST
SAND HOPPER
MENS RESTROOM
WOMENS RESTROOM
LOCKERS
BENCH
LUNCH ROOM
COVERALL CAGE
FILE
AISLE
TABLE
I V D
RACKS
STOR SHELVES


INTERNAL MOVE
10M
EXTERNAL MOVE
36M
CLEAN
VAPOR DEGREASE
1.1.1.
TRICHLOROETHANE
AR
MASKING
AR
STRIP
SODIUM CYANIDE
SODIUM HYDROXIDE
AR
(MULTI DEPOSIT STRIP)
AR
(SILVER STRIP)
AR
(NITRIC ACID STRIP)
AR
SULFURIC ACID
NITRIC ACID
AR
RINSE
COLD
AR
REPEAT
IF REQUIRED
FERROUS METAL
IF REQUIRED
ALUMINUM
STEEL
STAINLESS STEEL
COBALT
NICKEL
STRIP ANODIZE
CITRIC ACID
PHOSPHORIC ACID
AR
RINSE
COLD
AR
CLEAN
ALKALINE
TRISODIUM PHOSPHATE
SODIUM HYDROXIDE
SODIUM METASILICATE
1-2m
TRISODIUM PHOSPHATE
SODIUM CARBONATE
1-2m
RINSE
VIGOROUS, COLD
15-60S
30-60S
ETCH
VIGOROUS, COLD
NITRIC ACID 50%
30-60S
10-3m
RINSE
VIGOROUS COLD
15-60S
30-60S
DEMASK
RINSE / DRY
AR
PRESERVATIVE
AR
AR
AR
DRY
SHOP AIR
AR
DEMASK
RINSE / DRY
AR
STRESS BAKE
3HR
MASKING
AR
CLEAN
ALKALINE
TRISODIUM PHOSPHATE
SODIUM HYDROXIDE
SODIUM METASILICATE
1-3m
SODIUM HYDROXIDE
TRISODIUM PHOSPHATE
1-3m
SODIUM HYDROXIDE
SODIUM CYANIDE
1-3m
RINSE
COLD
15-60S
1
2
A
B
3
4

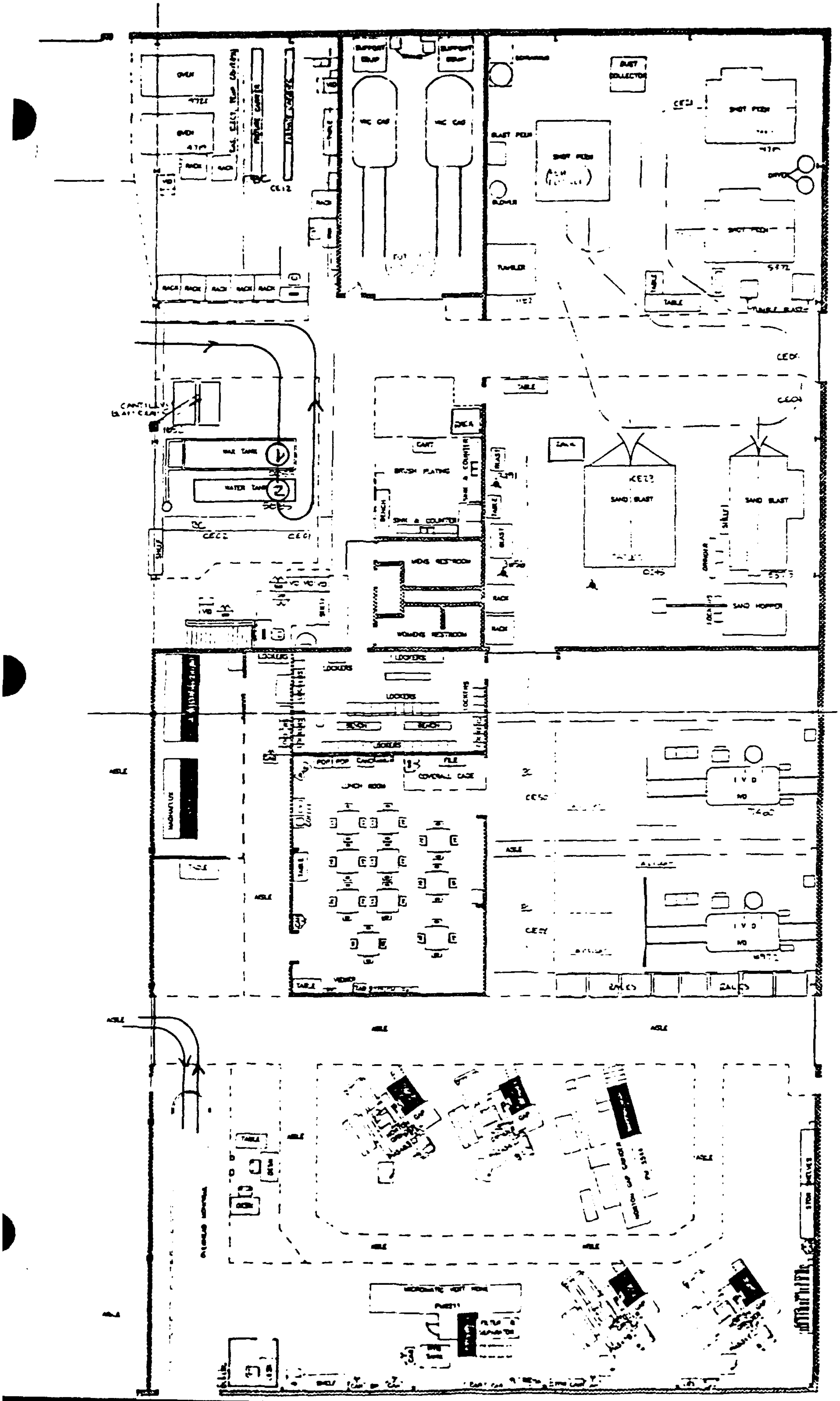


SILVER
2 OF 2
ETCH VIGOROUS
NITRIC ACID SULFURIC ACID ACETATE 70
10-30S
SULFURIC ACID 90%
10-30
RINSE VIGOROUS, COLD
30-60S
ZINCATE VIGOROUS
30S
DO NOT REPEAT STRIKE
STRIP ZINCATE VIGOROUS
NITRIC ACID 50%
5-20 S
NITRIC ACID 70% HYDROFLUORIC ACID 10%
5-20 S
RINSE VIGOROUS COLD
30-60S
REPEAT ONCE
11
S/ 11
SILVER STRIKE
20-30 S
12
S/ 12
SILVER PLATE
(NORMAL)
AR
(HI-SPEED)
AR
13
RINSE COLD
AR
14
DEMASK RINSE / DRY
AR
15
HYDROGEN EMBRITTLEMENT BAKE
3 HR
ST STEEL CASTING NICKEL
STEEL
5
ETCH
A
SULFURIC ACID 25% HYDROFLUORIC ACID 5%
30-60S
HYDROCHLORIC ACID 15%
30-60S
DRY ACID SALTS
30-60S
SULFURIC ACID 10%
30-60S
SULFURIC ACID 40%
30-60S
6
RINSE
15-60S
CYANIDE DIP
OPT. STEEL, ST STEEL NICKEL
AR
7
S/ 7
COPPER STRIKE
OPT. ALUM, STEEL
3-7 m
8
RINSE COLD
15-60S
30-60S
9
ALUM
ST STEEL NICKEL
STEEL
NICKEL STRIKE
SOFT LOW STRESS (AL)
10-12 m
ELECTROLESS NICKEL (AL)
10-12 m
NICKEL STRIKE
4-6 m
HIGH COMPRESSIVE STRESS
4-6 m
S/ 9
NICKEL SULFAMATE
4-6 m
30-60S
10
RINSE COLD
15-60S
15-60S
PRESERVATIVE
AR
AR
AR
RINSE COLD
AR

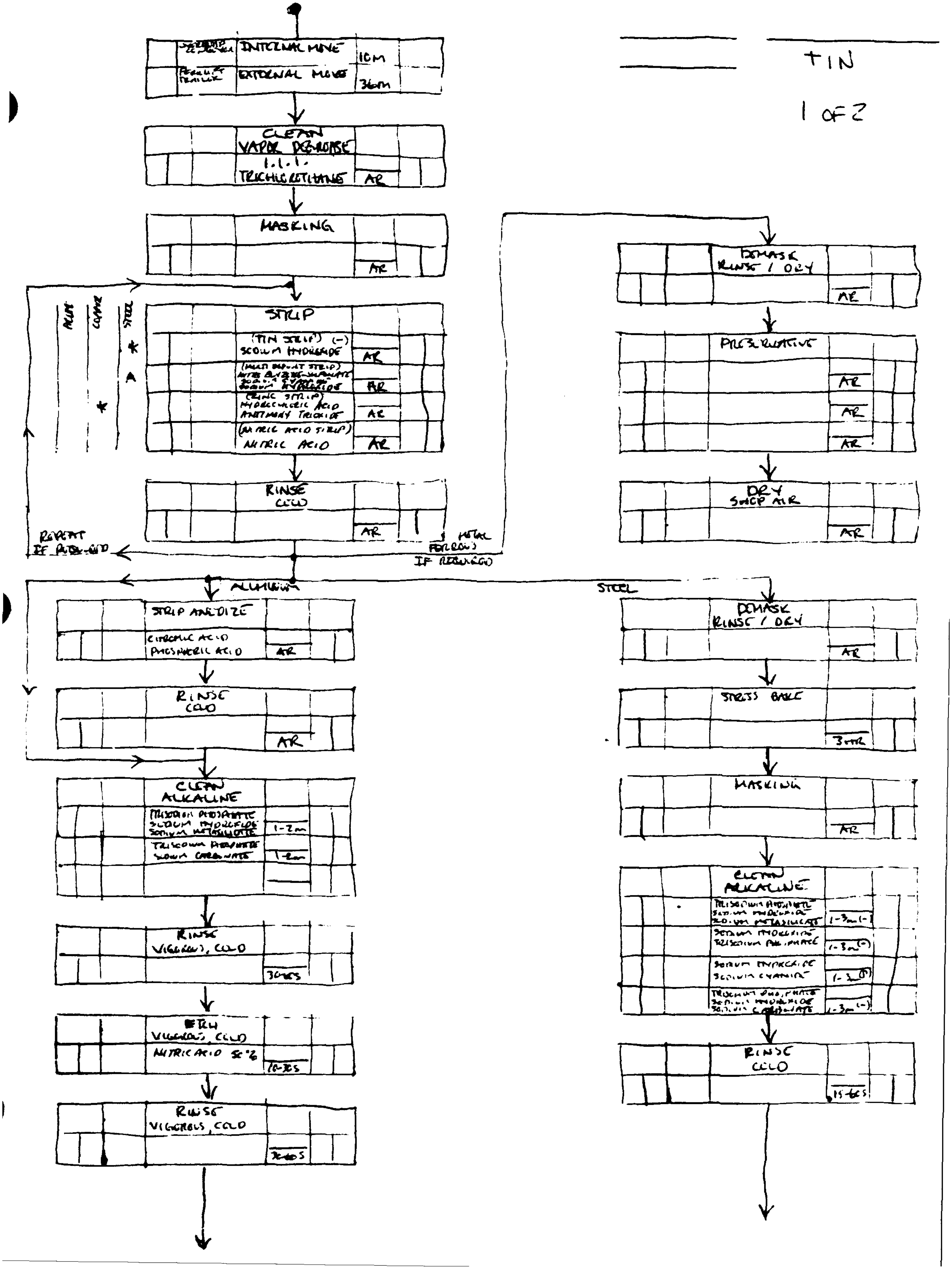


14 CARRIERS
24 CARRIERS
RACKS
HOT RINSE
COLD RINSE
CHROME PLATE
RUST STR
VAPOR DEG
CHROME STRIP
CAD STRIP
CLEANER
INSPECTION BOOTH
DRYER
CADMIUM PLATE
FUTURE ELECTROLESS NICKEL LINE
AISLE

Silver
1 of 2

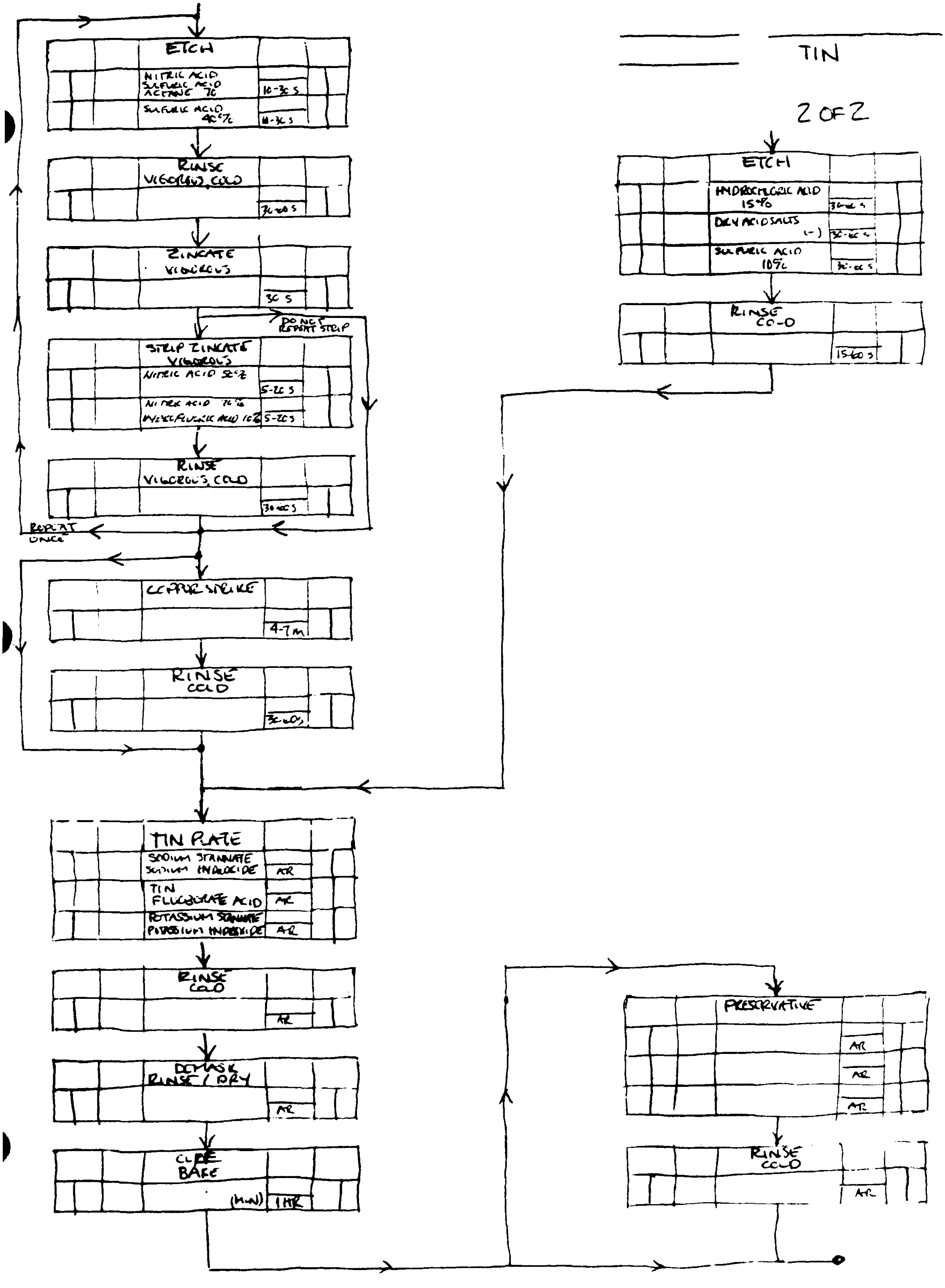

OVEN
OVEN
RACK
SHOT PEEN
SHOT PEEN
SHOT PEEN
DUST COLLECTOR
BLAST PEEN
BLOWER
TUMBLER
TABLE
TUMBLE BLAST
WAX TANK
WATER TANK
CART
BRUSH PLATING
SINK & COUNTER
BENCH
SAND BLAST
SAND BLAST
SAND HOPPER
MENS RESTROOM
WOMENS RESTROOM
LOCKERS
BENCH
FILE
COVERALL CAGE
LUNCH ROOM
MAGNAFLUX
AISLE
I V D
VIDEO
TABLE
MICROMATIC HONE
FILTER & SEPARATOR
DESK

SILVER
2 OF 2

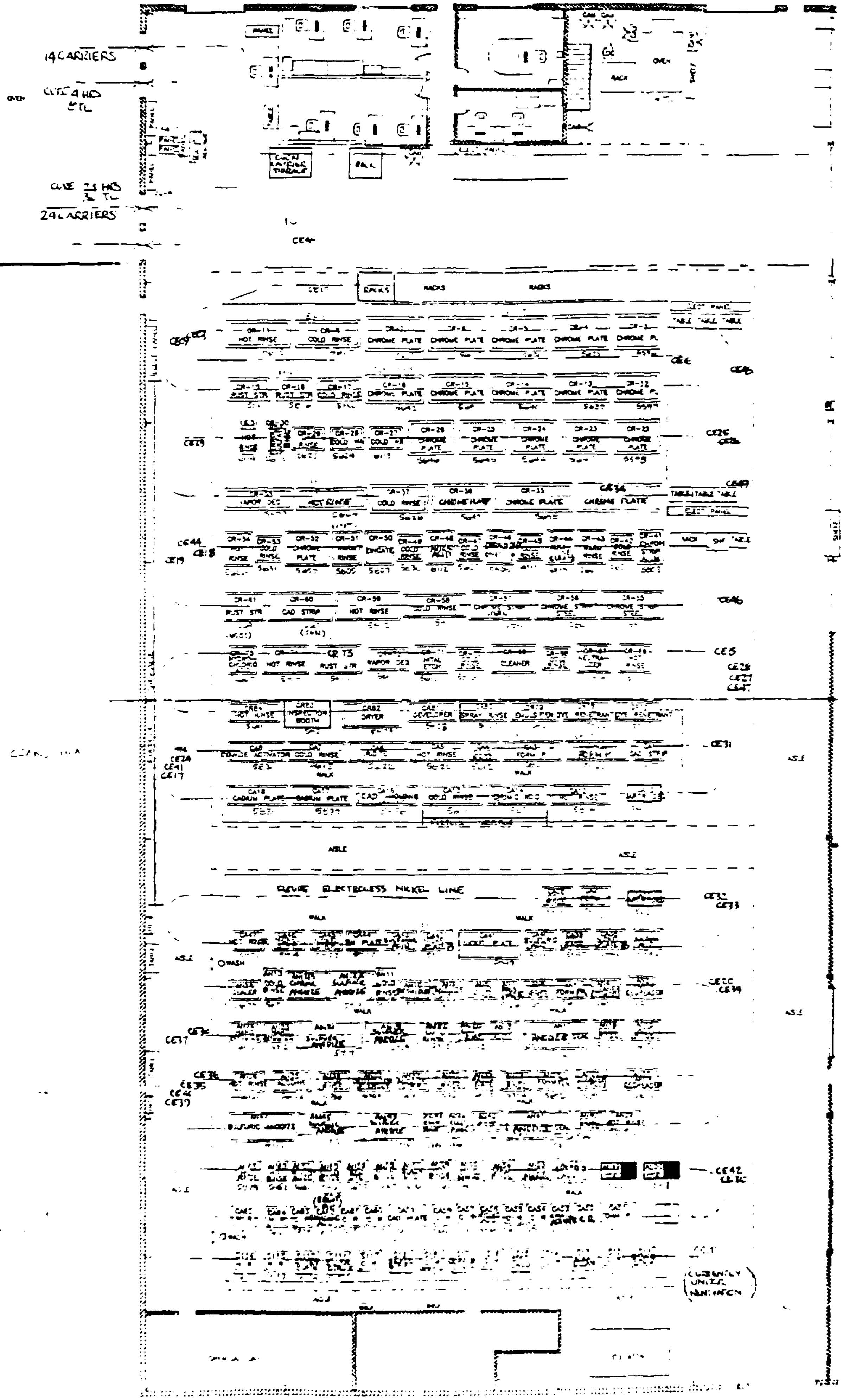

INTERNAL MOVE 10M
EXTERNAL MOVE 36M
CLEAN
VAPOR DEGREASE
1.1.1. TRICHLOROETHANE AR
MASKING AR
STRIP
ALUM COPPER STEEL
(TIN STRIP) (-)
SODIUM HYDROXIDE AR
AR
(ZINC STRIP)
HYDROCHLORIC ACID
ANTIMONY TRIOXIDE AR
(NITRIC ACID STRIP)
NITRIC ACID AR
RINSE
COLD AR
REPEAT IF REQUIRED
METAL FERROUS IF REQUIRED
ALUMINUM
STEEL
STRIP ANODIZE
CHROMIC ACID
PHOSPHORIC ACID AR
RINSE
COLD AR
CLEAN
ALKALINE
SODIUM HYDROXIDE
SODIUM METASILICATE 1-2m
SODIUM CARBONATE 1-2m
RINSE
VIGOROUS, COLD
ETCH
VIGOROUS, COLD
NITRIC ACID 50%
RINSE
VIGOROUS, COLD
DEMASK
RINSE / DRY AR
PRESERVATIVE AR AR AR
DRY
SHOP AIR AR
DEMASK
RINSE / DRY AR
STRESS BAKE 3HR
MASKING AR
CLEAN
ALKALINE
SODIUM HYDROXIDE
SODIUM METASILICATE
SODIUM HYDROXIDE
SODIUM CYANIDE
RINSE
COLD

TIN

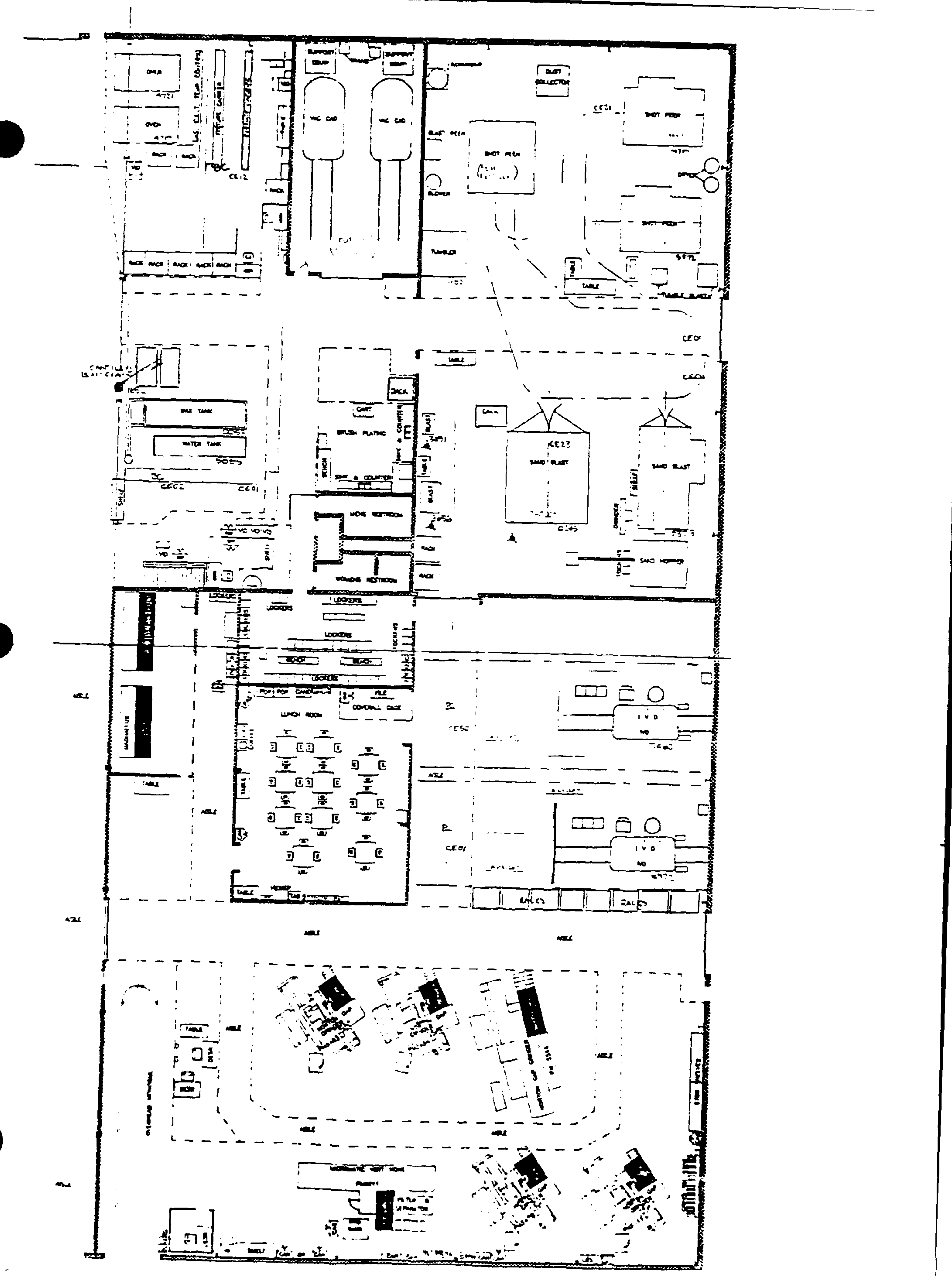
2 OF 2



ETCH
NITRIC ACID
SULFURIC ACID
10-30 S
SULFURIC ACID
10-30 S
RINSE
VIGOROUS, COLD
30-60 S
ZINCATE
VIGOROUS
30 S
DO NOT REPEAT STRIP
STRIP ZINCATE
VIGOROUS
NITRIC ACID 50%
5-20 S
NITRIC ACID 70%
HYDROFLUORIC ACID 10%
5-20 S
RINSE
VIGOROUS, COLD
30-60 S
REPEAT ONCE
COPPER STRIKE
4-7 m
RINSE
COLD
30-60 S
TIN PLATE
SODIUM STANNATE
SODIUM HYDROXIDE
AR
TIN
FLUOBORATE ACID
AR
POTASSIUM STANNATE
POTASSIUM HYDROXIDE
AR
RINSE
COLD
AR
DEMASK
RINSE / DRY
AR
CURE
BAKE
(MIN)
1 HR
ETCH
HYDROCHLORIC ACID
15%
30-60 S
DRY ACID SALTS
(-)
30-60 S
SULFURIC ACID
10%
30-60 S
RINSE
COLD
15-60 S
PRESERVATIVE
AR
AR
AR
RINSE
COLD
AR



14 CARRIERS
24 CARRIERS
OVEN
RACK
RACKS
CE44
CR-11 HOT RINSE
CR-6 COLD RINSE
CHROME PLATE
CR-16 CHROME PLATE
CR-15 CHROME PLATE
CR-14 CHROME PLATE
CR-13 CHROME PLATE
CR-12 CHROME PL
CR-28 CHROME PLATE
CR-25 CHROME PLATE
CR-24 CHROME PLATE
CR-23 CHROME PLATE
CR-22 CHROME PLATE
CR-37 COLD RINSE
CR-36 CHROME PLATE
CR-35 CHROME PLATE
CE34
CHROME PLATE
CR-52 CHROME PLATE
CR-50 ZINCATE
CR-61 RUST STR
CR-60 CAD STRIP
CR-59 HOT RINSE
CR-58 COLD RINSE
HOT RINSE
CR 73 RUST STR
VAPOR DEG
CLEANER
CE5
INSPECTION BOOTH
CR82 DRYER
DEVELOPER
SPRAY RINSE
CE31
COLD RINSE
HOT RINSE
CADMIUM PLATE
COLD RINSE
AISLE
ELECTROLESS NICKEL LINE
CE32
CE33
WALK
CE42
CAD PLATE
CURRENTLY UNDER RENOVATION



OVEN
OVEN
RACK
RACK RACK RACK RACK RACK
SUPPORT EQUIP
SUPPORT EQUIP
VAC CAD
VAC CAD
DUST COLLECTOR
SHOT PEEN
SHOT PEEN
SHOT PEEN
BLAST PEEN
BLOWER
TUMBLER
TABLE
TABLE
TUMBLE BLAST
WAX TANK
WATER TANK
CART
BRUSH PLATING
BENCH
SINK & COUNTER
SAND BLAST
SAND BLAST
GRINDER
SHELF
RACK
RACK
SAND HOPPER
MENS RESTROOM
WOMENS RESTROOM
LOCKERS
LOCKERS
LOCKERS
LOCKERS
BENCH
BENCH
LUNCH ROOM
COVERALL CAGE
FILE
TABLE
I V D
I V D
AISLE
AISLE
AISLE
AISLE
AISLE
AISLE
TABLE
DESK
TABLE
SHELF

— INTERVIEWS —

* REFERENCE SOURCE INITIALS

(SCHEDULER) RAY GALLANT

(MANUFACTURING WORKER) ED KELLER, DENNIS COPENHAVER, JIM MCATEE

(LINE FOREMAN) SHARON BILLMIRE, RON FIELDS, ROGER SIMONS, IGNACIO OLVORA

(ENGINEERING) ANAHN SHAH, MARK CHILD

(EXPEDITOR) NONE EXISTING CURRENTLY

WORKLOAD:

FLUCTUATIONS USUALLY OCCUR NEAR THE BEGINNING OF THE QUARTER WITH THIRTY PERCENT OF THE TOTAL WORKLOAD FOR THE QUARTER. FIFTY PERCENT NEAR THE END OF THE QUARTER AND TWENTY PERCENT IN THE MIDDLE. *RS,

THESE FLUCTUATIONS ARE DUE TO OTHER AREAS CLEANING UP THE INVENTORY LEVEL IN THEIR AREA AND SCHEDULING PUSHING ITEMS THRU. OTHER REASONS ARE DUE TO IMPROPER SCHEDULING OF PRIORITY AND ALLOWING ENOUGH TIME FOR ENTIRE PROCESS *RS, SB

THE WORKLOAD WITHIN MANPRC CONSISTS OF MISTR AT 92%, PDM AT 5%, TEMPORARY AT 3% *ES

" " 85%, " " 5% " " 10% *RG

REPAIR PROCESS:

THE PROCESSES WITHIN MANPRC CONSIST OF BAKING (RELIEF OF HYDROGEN EMBRITTLEMENT, STRESS, AND CURING); GRIT BLAST, SHOT PEEN (SURFACE COMPRESSION STRESS RELIEF, CLEANING); VAPOR DEGREASE, PLATING, COATING, STRIPPING (CHROME, CADMIUM, SILVER, COPPER, TIN, NICKEL PLATINGS; ANODIZE, ALODINE, PHOSPHATE, PASSIVATION COATINGS; ION VAPOR DEPOSITION, CADMIUM, CHROME, RUST, NICKEL STRIPPING)

THERE ARE SEVERAL BASIC REASONS FOR CONDEMNING PARTS: ARC-BURN THE PART (CAUSED BY IMPROPER FIXTURE SETUP, PART STICKING OUT OF SOLUTION, AND PART TOUCHING INSIDE TANK WALL, ANODE OR OTHER PARTS), MATERIAL HANDLING (DAMAGED WHEN MOVING/STORING PARTS), REVERSE ETCHING (ELECTRICAL CONTROL INCORRECTLY SET), RUN OUT (CHEMICALS ARE TRAPPED DURING CLEANING PROCESS THEN ETCH AWAY PART. THE MAJORITY OF THE REWORK IS DUE TO ARC-BURN OR MATERIAL HANDLING DAMAGE WITH ONE PART PER YEAR UNREPAIRABLE (CONDEMNED). *RS, MC

STAFF:

THE WORKFORCE IS FAIRLY STABLE. EMPLOYEE EXPERIENCE LEVEL IS ADEQUATE FOR ASSIGNMENT, AS EMPLOYEES GAIN MORE EXPERIENCE THE FOREMAN MOVES THEM TO A HARDER WORK STATION. AFTERWARDS THEY GO THRU A TRAINING/APPRENTICE PERIOD. *SB, RF

SOMETIMES TRAINING OCCURS LONG BEFORE HANDS ON EXPERIENCE. I WAS GIVEN TWO EXAMPLES WHERE CLASSES WERE 8 MO. AND 18 MO. PRIOR TO ACTUAL HANDS ON EXPERIENCE, BY THIS TIME TRAINING IS FORGOTTEN. *RS

OTHER DEPARTMENTS ARE OVER SCHEDULING, EXPEDITING, TOOL DESIGN & BUILD, EQUIPMENT RENOVATION, MATERIAL SUPPLIES, CHEMICAL ANALYSIS OF TANKS, MOVEMENT OF PARTS TO/FROM BLDG.

# DIRECT EMPLOYEES	SKILL (UP) LEVEL/CODE	WORKSTATIONS QUALIFIED FOR	AVG YRS EXPERIENCE
1	WG05/6910	FORKLIFT DRIVERS	5
6	WG05/3711	PLATING/GRITBLAST TRAINEES	1
2	WG07/4749	PUMPERS (EQUIPMENT SUPPORT)	4
8	WG07/3711	ASSOCIATE JOURNEYMAN (HARDCOAT ANODIZE, CHROME, CAD, IRIDITE)	4
7	WG08/3769	JOURNEYMAN (SHOT PEEN, GRIT BLAST)	9
34	WG09/3711	JOURNEYMAN (ALL EXCEPT SHOT PEEN, GRIT BLAST)	11
6	WS09/3711	FOREMAN/TRAINER	13
64			

*IO

EQUIPMENT:

EQUIPMENT IS MAINLY COMPRISED OF CLEANING & PLATING TANKS, WITH VARIOUS SUPPORT EQUIPMENT SUCH AS AN OVERHEAD CRANE SYSTEM (TRACK LINE LOOPED ON LINES 1&2, 3&4, ...), ventilation system, rectifiers, SOLUTION PUMP/HOLDING TANKS, AIR mechanical AGITATION, FIXTURES (RACK), STORAGE RACKS. OTHER EQUIPMENT INCLUDES OVENS, GRIT BLAST, SHOT PEEN, ION VAPOR DEPOSITION, MASKING STATION, EACH WITH SEPARATE CRANE SYSTEM.

PROBLEM AREAS INCLUDE: PROCEDURE TO OBTAIN PARTS/SUPPLIES THAT COULD POSSIBLE STOP THE LINE ARE too time CONSUMING AND COMBERSOME. REPLACEMENT PART SUPPORT STOCKING SYSTEM HAS INADEQUATE WORKING STOCK ON HAND. PROCESS LINE CHEMICALS AREN'T READILY AVAILABLE. MECHANICAL CHEMICAL PREVENTATIVE MAINTENANCE ON SOLUTION TANKS SHOULD BE BETTER, SEVERAL ARE OUT OF COMMISION. ELECTRIC SURGES CAN TEMPORARILY DAMAGE RECTIFIERS ~~FOR~~ TANK. AN AIR OUTAGE COULD STOP AIR AGITATION ON CRITICAL PROCESSES. FIXTURING BUILD TIME TAKE TO LONG. SEVERAL TIMES A PROJECT HAS BEEN FINISHED BEFORE THE FIXTURE IS DESIGNED BUILT AND COMES IN FOR USE. (PRODUCTION IMPROVISED TO MEET SCHEDULING DEMAND). *RS

ENGINEERING SUPPORT:

'The process engineer ~~is~~ Actively WORKING ON PROBLEMS WITH PROCESS/ FACILITY AND MAKES HIMSELF AVAILABLE. However the foreman have the tendency to leave him out of line problems. They need another engineer that can spend more time on the floor solving little problems. The civil engineer is almost never available and then it takes forever before the problem is fixed

*RS

WORK SCHEDULE:

'There are three shifts with half of the work force on day shift. Currently they are remodeling ONE THIRD OF THE SHOP AT A TIME. This has caused an excessive amount of O/T attempting to meet production schedule. They normal can meet scheduling demands without working many WEEKENDS.

*RE,R

RG

CHANGES THEY WANT:

The ~~three~~ largest problems are storage, and flow, scheduling. Because of the lack of storage space their staging area is used as a warehouse by them and other departments. They have little room to walk in many places. Scheduling part flow between processes and completion dates.

Miscellaneous problems are lack of lighting to see work. The intercome is cranked up but not understandable. Employees waste time walking to/from phone in office at end of plant. Temperature is too high during summer months. It smells horrible at times.

* RS

MISCELLANEOUS:

A BETTER SELECTION OF FIXTURE. There are times that they don't have enough to work on the SCHEDULED WORKLOAD * DC, EL, JM

They use forklifts and trailers to move 75% of work between bldg 507 AND 505 they should use overhead conveyor system more for ~~cause~~. damaged parts

* RF, RS

THE FOLLOWING PAGES CONTAIN INFORMATION WHICH WAS USED BY RON LEE TO SUPPORT HIS ANALYSIS OF MAN PRC.

to get as good conductivity as possible, along with good current efficiency, satisfactory deposits, and stable solution composition. The specific gravity of the baths provides a rough measure of the concentration of chromic acid, especially if due allowance is made for other salts known to be present.

THEORY

As pointed out by Blum and Hogaboom [13], no satisfactory theory of chromium plating from chromic acid baths has been proposed beyond the principles stated. The theories to date lack comprehensiveness both in the investigations on which they are based and in the explanations proposed. The purity of the chromic acid used is often not specified or established, and yet the nature of the results depends on it. Many workers continue to report some reduction and chromium deposition in "pure" chromic acid solution, but in the writer's experience, confirmed by Vagramyan and Usachev [16], this is not possible: In the electrolysis of pure chromic acid solutions only hydrogen evolution is obtained under most conditions.

Even the simplest questions cannot be answered with our present knowledge. Why is it possible to deposit chromium from chromic acid solutions when small amounts of various anions are added? Why does the current efficiency vary so widely with the temperature, the current density, the concentration of chromic acid, and the proportion of catalyst anion? Why do different anions give such widely different results? Why do fluoride additions give only dark, dull deposits if no sulfate is present [17–19]? These are only a few of the questions which any satisfactory theory should answer.

The author has reviewed older work on the theory of chromium deposition in the previous edition of this volume [7]. This related largely to the study of the film formed at the cathode during plating. Such work now seems partly rather irrelevant and redundant since the commercial use of such films on extremely thin chromium plate to produce tin-free steel (TFS) for "tin cans" has resulted in a highly developed new art which is discussed in a later section.

No film is visible ordinarily. On the other hand, irregular etching of chromium deposits in the production of porous chromium has been noted by Dubpernell [20]; the type of etching is probably due to the presence of such an invisible film. This irregular, patchy etching was avoided by reducing the current density for a few minutes at the end of the chromium plating operation to, or below, the region where chromium deposition begins.

Kasper [21] concluded that chromium deposited from the hexavalent state. This was confirmed by the use of radioactive chromium compounds as tracers [22]. Although it seems somewhat anomalous that it should be easier to deposit the metal from the higher valence state, such behavior is not unknown and can be confirmed thermodynamically in some instances. In

the present case, the free energies of formation of CrO_3 and $\frac{1}{2}Cr_2O_3$ have been given by Coughlin [23] as $-121{,}000$ and $-126{,}575$ cal, respectively, an indication of slightly easier decomposability for chromic acid than for trivalent salts.

Similarly, Levitan [24] selects the reduction potential of chromium(VI) (bichromate) to metal as $+0.4$ V from Udy [25], chromium(III) to metal as -0.74 V from Latimer [26], and chromium(II) to metal as -0.91 V, also from Latimer. This would indicate that chromous salts are the most difficult to reduce to metal, in agreement with the findings of many workers. Pourbaix [27] is in agreement with these figures and calculates the reduction potential of chromium from bichromate as $+0.3$ V, making chromium theoretically easier to deposit than hydrogen from such solutions.

It should be noted that Udy [25] considered chromium(III) more difficult to reduce than chromium(II), and calculated a reduction potential of -0.9 V for chromium(III) and -0.5 V for chromium(II). This too is in agreement with the experience of many others, the findings being about equally divided.

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Workers occupied with chromium(II) and chromium(III) salt solutions have paid insufficient attention to what might be called the principle of maximum purity for maximum cathode potential or maximum overvoltage. Mercury is a useful cathode for the electrodeposition of almost all metals because of an overvoltage of 1 V or more. However, Harrison and Thirsk [28] have shown that the deposition of little more than a monolayer of platinum or ruthenium on the mercury is sufficient to decrease the overvoltage by 0.4 or 0.5 V or even more. Thus almost infinitesimal quantities of many metal impurities are probably sufficient to cause the deposition of a black smut instead of solid metal, and this creates a low-overvoltage surface on which it is easy to evolve hydrogen and difficult or impossible to deposit chromium. Even iron, which is omnipresent in chromium ore and all through most of the salts, may be such an impurity (catalyst for hydrogen production). Such impurities have to be identified and eliminated, or else masked or combined in a complex compound which renders them harmless. Even with chromic acid solution, Bedi and Dubpernell [29] have shown that chromium deposition can be prevented

CHROMIUM PLATING

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ROBERT DRAPER LTD.
83/85 UDNEY PARK ROAD, TEDDINGTON, MIDDLESEX,
ENGLAND
1954

100:1; different workers have recommended values ranging from 86:1 to 116:1.

Fig. 10 shows the variation of cathode efficiency with sulphate content at temperatures of 113°F. and 140°F. within a range of current density from 185-465 amp./sq. ft.

Effect of Secondary Variables

(a) Trivalent Chromium and Ferric Iron

The trivalent chromium concentration of the solution increases gradually and then becomes constant as a result of the opposing reactions at the two electrodes. If iron anodes are used, the iron concentration also increases.

The cathode efficiency is almost independent of the concentration of trivalent chromium and iron as demonstrated in Fig. 11.

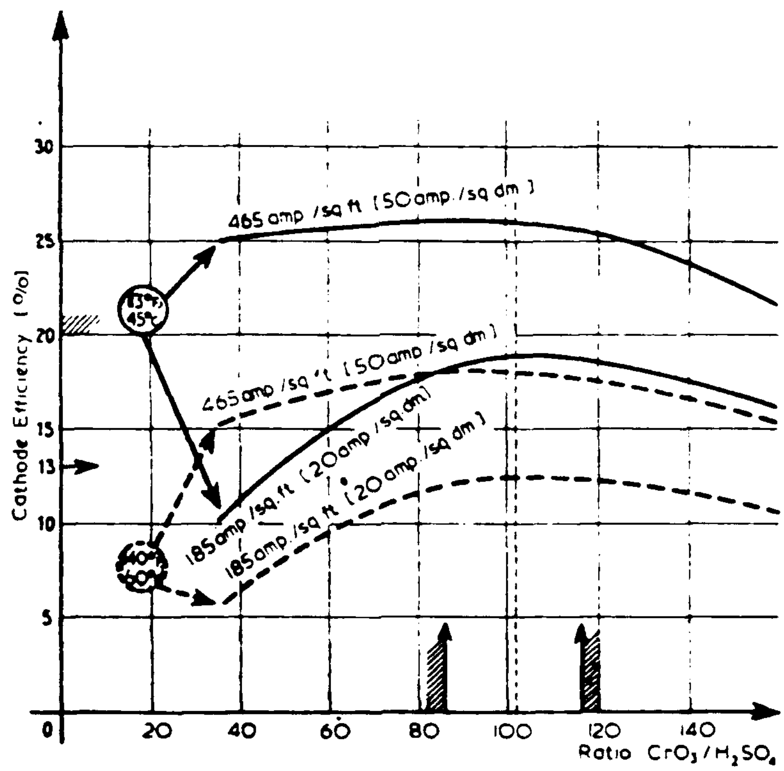

Fig. 10. Relation between cathode efficiency and sulphate content at different current densities and temperatures (SCHNEIDEWIND).

However, if the total concentration of trivalent chromium and iron exceeds approximately 3 oz./gal., sudden changes in electrical properties take place and the resistance of the solution is greatly increased. The total concentration should, therefore, be maintained

at less than 3 oz./gal. although for some purposes good deposits are obtained above this limit.

Whilst normal concentrations of trivalent chromium have relatively little effect on current efficiency, it should be noted, however, that deposition commences at a lower current density in solutions containing trivalent chromium than in those which do not (Ollard and Smith[20]). Fig. 12 shows the relation between current density and current efficiency for two solutions, one containing trivalent chromium and the other containing only chromic acid and sulphate. It can be seen that, in the former solution, deposition commences with a current density d_1 whilst in the second it only starts when the higher current density d_2 is reached. On the other hand, for current density d_3, the current efficiency is higher for the unreduced solution. This consideration is of practical value when it is necessary to use low current densities for deposition. In such cases, the presence of trivalent chromium is an advantage.

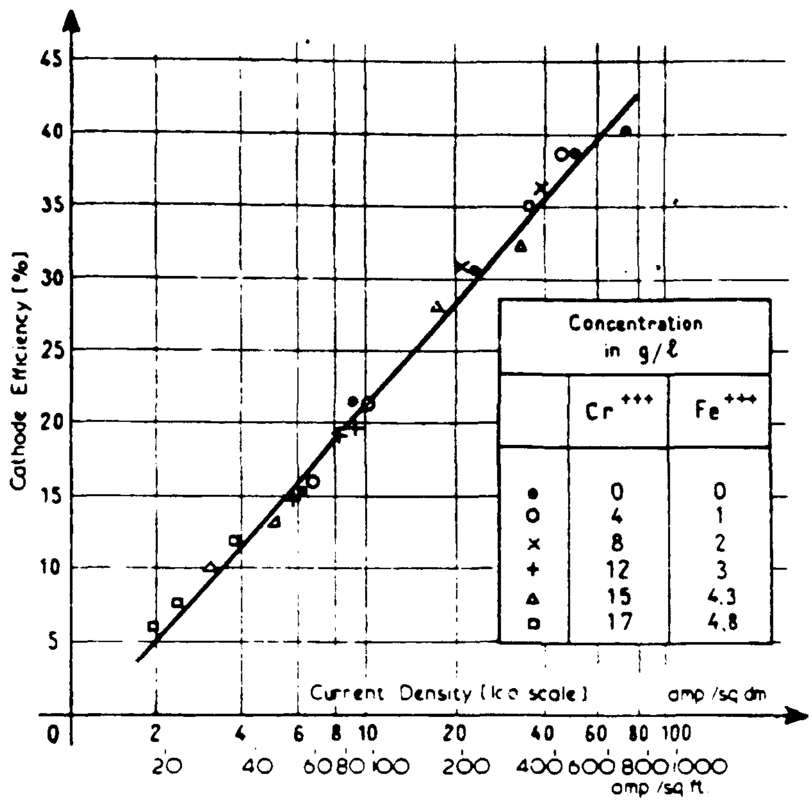

Fig. 11. Effect of trivalent chromium and iron on cathode efficiency. Bath temperature 25°C. (SCHNEIDEWIND, URBAN AND ADAMS).

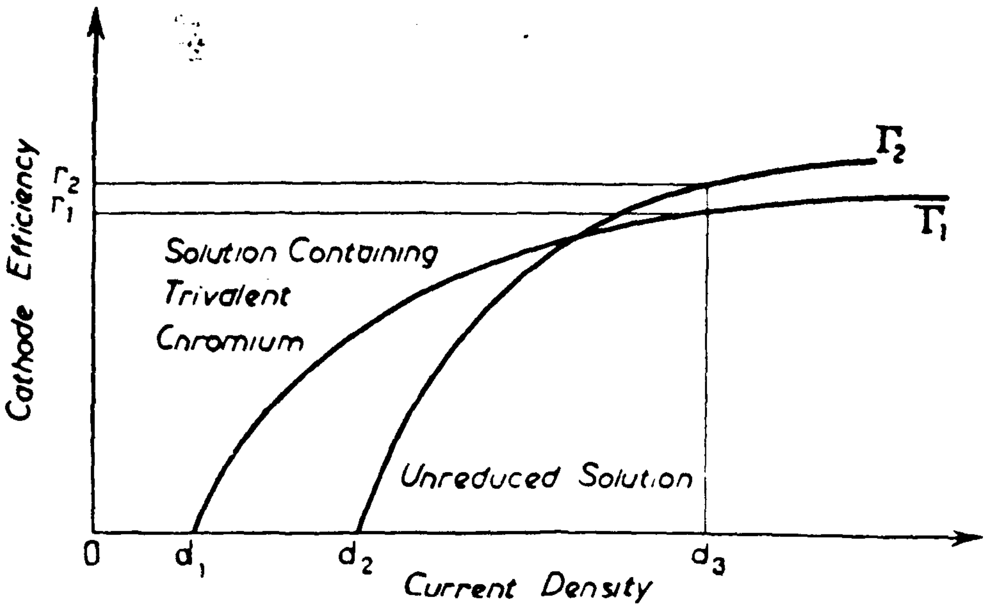

Fig. 12. Relation between cathode efficiency and current density for solutions with and without trivalent chromium (OLLARD AND SMITH).

(b) Anions other than Sulphate

Various anions have been proposed for replacing SO_4'', *e.g.*, Cl', NO_3', B_4O_7'', but these have no significant effect in increasing the cathode efficiency. The anions SiF_6'' and F' give some increase in cathode efficiency as shown in Fig. 13 (Bilfinger[28]). This graph

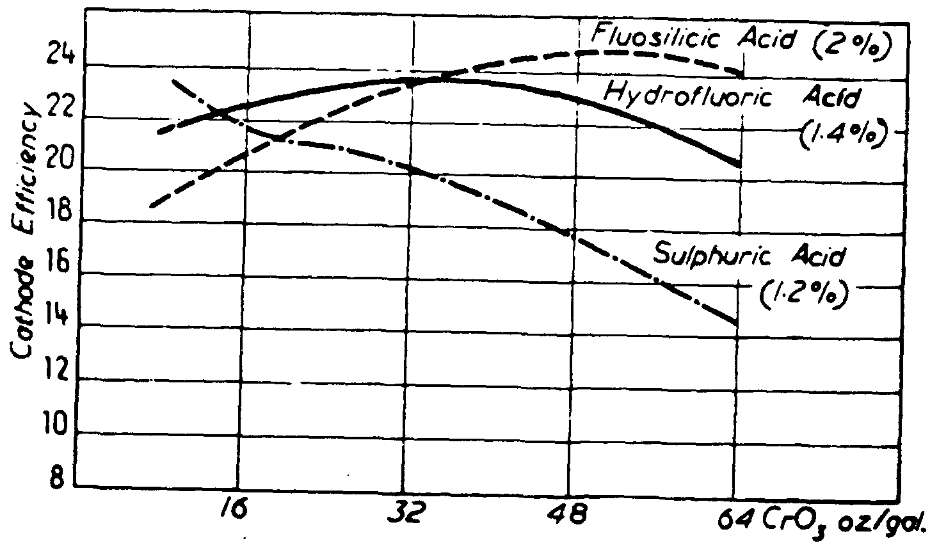

Fig. 13. Effect of nature of anion added to chromic acid solutions on cathode efficiency (BILFINGER).
16 oz./gal. ≡ 100 g./l.

quantity of barium hydroxide into a bag woven from plastic (P.V.C.) yarn. To prevent clogging, it is advisable to make alternate layers of barium hydroxide and glass wool. Such a bag can be hung in the solution and the sulphate content reduced in a reasonable time. In addition, the insoluble material is removed and does not remain in the vat.

Iron

Iron occurs as an impurity in chromium plating solutions, the main sources of contamination being the use of iron anodes in place of lead and reverse current etching of steel parts in the solution. The presence of iron is usually considered to be a serious defect as there is no practical method for eliminating it. However, by using lead anodes and avoiding over-etching, loss of solution by drag-out is usually sufficient to keep the iron content below the danger level and it is very seldom in practice that a chromium plating solution has to be scrapped because of iron contamination. The effect of high iron concentration is to cause brittleness in hard chrome deposits, loss of brilliance in bright chrome, and reduction in throwing power.

Frequency of Analysis of Chromium Plating Solutions

The rate of variation in the concentration of the constituents depends on the type of work being treated, the volume of solution, and the way the bath is handled. The recommendations given in Table LI are, therefore, only intended to be in the nature of a guide ; local conditions will determine the exact requirements.

Table LI. Guide to Frequency of Analysis of Chromium Plating Solutions.

Density Measurement		Weekly, daily in some plants
Analysis for	Chromic acid	Weekly
,, ,,	Sulphuric acid	Each time chromic acid is added
,, ,,	Trivalent chromium	As necessary
,, ,,	Iron	As necessary, but not more than once every three months
,, ,,	Mixed " chromates "	ditto.
,, ,,	Nickel, copper and zinc	ditto.
,, ,,	Fluorides and Silico-fluorides	ditto.

5 ·

Chromium

George Dubpernell

There are two principal classes of chromium plating: "decorative," in which thin coatings serve as a nontarnishing, durable surface finish; and industrial or "hard" chromium, where heavy coatings are used to take advantage of the special properties of chromium, including resistance to heat, wear, corrosion and erosion, and low coefficient of friction. In these steadily increasing industrial applications, the chromium is usually deposited directly on the basis metal without intermediate coatings. Sometimes, especially on cutting tools, the thickness of these hard chromium coatings is no greater than that of decorative ones.

The commercial process of chromium plating resulted principally from the work of Fink and Eldridge, in 1923 and 1924 [1, 2]. Liebreich [3] made similar discoveries more or less simultaneously in Germany, but confused them by overemphasis on the supposed importance of the trivalent chromium also present in the chromic acid-sulfate bath.

A noteworthy improvement in chromium plating from chromic acid solutions came with the introduction of the SRHS* (self-regulating high-speed) baths in 1949 [4]. These baths, using a double catalyst system, generally sulfate and silicofluoride, are simple to operate and control and offer advantages discussed later.

For more details of the history of chromium plating see references 1 and 5–12. Blum and Hogaboom [13] emphasize the effect of the introduction of chromium plating on other electroplating processes.

PRINCIPLES

Chromium cannot be deposited from a solution containing only chromic acid (CrO_3) and water. There must also be present in the bath one or more

*Trademark of M & T Chemicals Inc.

acid radicals which act as catalysts to bring about or aid in the cathodic deposition of chromium. Those most commonly used are sulfate and fluoride, the latter generally in the form of a complex fluoride such as silicofluoride (SiF_6^{2-}) [14], since simple fluorides are effective in such small quantities that control becomes difficult. For successful continous operation, the ratio (by weight) of chromic acid to total catalyst acid radicals must be maintained within definite limits: preferably about 100–1 in the case of sulfate [2, 3].

It is generally immaterial what other substances the catalyst is combined with when it enters the bath or from what sources it may be derived, but the material must be soluble. Some sulfate is ordinarily present in all chromium plating baths, since it is contained in even the best commercial grades of chromic acid. Sulfuric acid and sodium sulfate are the most common sources of sulfate; fluosilicic acid and silicofluorides [14] are the most common sources of fluoride. References to the amount of catalytic agent or acid radical in a bath usually mean the total of such agents, although the method of totaling them varies and needs to be indicated.

Although the current efficiency in chromium plating baths is low (generally in the range 10–25% for bright plate), a fairly high rate of deposition is obtained owing to the relatively high current densities used. The voltages required are higher than in most other electroplating processes: generally 4 to 10 V, depending on operating conditions. Consequently, the generator capacity required for chromium plating is higher than that for most other metal plating, but this disadvantage has not seriously hindered the widespread use of the process.

The throwing power of chromium plating baths is relatively poor. Nevertheless, remarkable coverage is achieved, even in the plating of articles of irregular shape, if the optimum ratio of chromic acid to total catalyst acid radicals is carefully maintained. Special auxiliary anodes are sometimes used in order to cover deep hollows or recessed portions, and especially to obtain uniform thickness in hard chromium plating (or even in thicker decorative plating to produce more uniform microcracking). Such auxiliary anodes are similar to those used in other types of plating and are designed in accord with well-known and long-established principles of ample size for current-carrying requirements and proper spacing for uniform distribution of current.

The conductivity and density of pure chromic acid solutions are shown in Figure 1, based on the measurements made at the National Bureau of Standards [15]. Small amounts of chromium(III) and other cations decrease conductivity. It should be noted that the maximum conductivity is not achieved until a concentration of 400 to 500 g/l is reached. Commercial chromium plating generally uses baths containing 200 to 400 g/l chromic acid

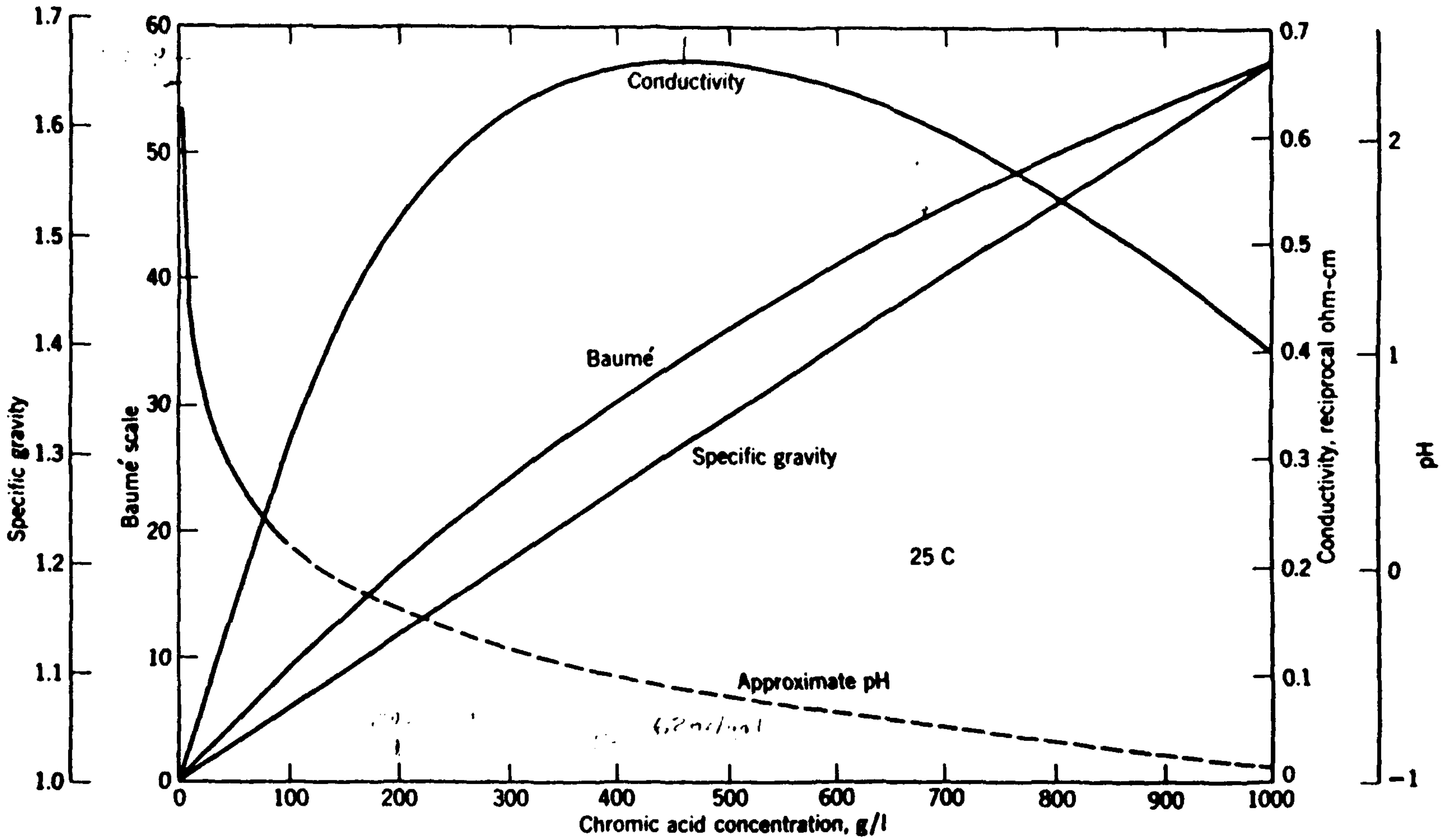

Fig. 1 Some physical properties of chromic acid solutions.

to get as good conductivity as possible, along with good current efficiency, satisfactory deposits, and stable solution composition. The specific gravity of the baths provides a rough measure of the concentration of chromic acid, especially if due allowance is made for other salts known to be present.

THEORY

As pointed out by Blum and Hogaboom [13], no satisfactory theory of chromium plating from chromic acid baths has been proposed beyond the principles stated. The theories to date lack comprehensiveness both in the investigations on which they are based and in the explanations proposed. The purity of the chromic acid used is often not specified or established, and yet the nature of the results depends on it. Many workers continue to report some reduction and chromium deposition in "pure" chromic acid solution, but in the writer's experience, confirmed by Vagramyan and Usachev [16], this is not possible: In the electrolysis of pure chromic acid solutions only hydrogen evolution is obtained under most conditions.

Even the simplest questions cannot be answered with our present knowledge. Why is it possible to deposit chromium from chromic acid solutions when small amounts of various anions are added? Why does the current efficiency vary so widely with the temperature, the current density, the concentration of chromic acid, and the proportion of catalyst anion? Why do different anions give such widely different results? Why do fluoride additions give only dark, dull deposits if no sulfate is present [17–19]? These are only a few of the questions which any satisfactory theory should answer.

The author has reviewed older work on the theory of chromium deposition in the previous edition of this volume [7]. This related largely to the study of the film formed at the cathode during plating. Such work now seems partly rather irrelevant and redundant since the commercial use of such films on extremely thin chromium plate to produce tin-free steel (TFS) for "tin cans" has resulted in a highly developed new art which is discussed in a later section.

No film is visible ordinarily. On the other hand, irregular etching of chromium deposits in the production of porous chromium has been noted by Dubpernell [20]; the type of etching is probably due to the presence of such an invisible film. This irregular, patchy etching was avoided by reducing the current density for a few minutes at the end of the chromium plating operation to, or below, the region where chromium deposition begins.

Kasper [21] concluded that chromium deposited from the hexavalent state. This was confirmed by the use of radioactive chromium compounds as tracers [22]. Although it seems somewhat anomalous that it should be easier to deposit the metal from the higher valence state, such behavior is not unknown and can be confirmed thermodynamically in some instances. In

the present case, the free energies of formation of CrO_3 and $\frac{1}{2}Cr_2O_3$ have been given by Coughlin [23] as −121,000 and −126,575 cal, respectively, an indication of slightly easier decomposability for chromic acid than for trivalent salts.

Similarly, Levitan [24] selects the reduction potential of chromium(VI) (bichromate) to metal as +0.4 V from Udy [25], chromium(III) to metal as −0.74 V from Latimer [26], and chromium(II) to metal as −0.91 V, also from Latimer. This would indicate that chromous salts are the most difficult to reduce to metal, in agreement with the findings of many workers. Pourbaix [27] is in agreement with these figures and calculates the reduction potential of chromium from bichromate as +0.3 V, making chromium theoretically easier to deposit than hydrogen from such solutions.

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entirely on steel by a small amount of an immersion deposit of platinum or palladium. Whittaker [30] found a decrease in current efficiency from 41 to 13% when using a palladium anode instead of lead.

Gerischer and Kappel (30a) emphasize that the film of chromium(III) chromate on the cathode must have semiconducting properties, and they feel that it can be reduced directly to metal. They further consider that the catalyst anions keep the film from growing too thick, and also inhibit hydrogen evolution, thus favoring chromium deposition.

It would seem that the deposition of chromium from chromic acid involves the reduction of some intermediate compound with the added anion, at the cathode, in the chromic acid medium of low or negative pH, and mixed activating and passivating tendencies. Thus, if the chromium deposit were too active, it would tend to redissolve in the strongly acid electrolyte. This may be a reason for the low current efficiency in high catalyst or "oversulfated" baths. Conversely, if the chromium deposit were too passive, it would tend to plate dull and in the form of nonadherent layers flaking from each other, as frequently occurs when there are current interruptions. Such current interruptions become less harmful or not harmful at all as the catalyst concentration and the temperature are increased, probably owing to greater activating power of the hot acid solution. While the tests were made only at 20°C, the investigation of the composition of the cathode film by Shluger and Mikhailova [31] seems significant. The film dissolves in the solution very rapidly when the current is interrupted, but by withdrawing the cathode with the current on and rinsing in distilled water, and repeating the operation 30 to 50 times, these workers were able to arrive at the approximate composition of the film by ordinary chemical analysis. This was done by subtracting a blank in each case found by using the same number of dips with the current off, giving a dragout representing the composition of the original solution. The results are given in Table 1, and it is evident that there is a film of fixed composition

TABLE 1 CATHODE FILM COMPOSITION

Number of Dips	Composition of Solution, g/l			Composition of Film, %			Weight of Film, g
	CrO_3	H_2SO_4	CrO_3/H_2SO_4	Cr^{6+}	Cr^{3+}	SO_4^{2-}	
30	300	3	100	67.4	20.0	12.6	1.06
50	316.7	4	80	67.6	22.4	10.0	2.63
30	300	5	60	70.6	16.3	13.1	2.49
50	316.7	6	53	68.5	20.0	11.5	4.93
50	316.7	11	29	66.6	23.4	10.0	10.36
30	300	12	25	61.0	28.4	10.6	6.01

regardless of the ratio of the chromium bath, and that it has a much higher sulfate content than the bath. The total weight of the film on the 22-cm^2 cathode is given in the last column, and shows that the film thickness increases with increasing sulfate content of the bath, using 40 A/dm^2.

Similar determinations of the film composition were reported by Solov'eva et al. [32], who found the cathode film to contain from 2.1 to 13.7 times as much sulfate as was present in the solution, with reference to the chromic acid concentration. The work was also done at 20°C, but under a wider range of conditions, ranging from 25 to 250 g/l CrO_3, 0.5 to 12.5 g/l H_2SO_4 (ratios 10–100), and at 250 and 500 mA/cm^2.

Solutions with fluoride or complex fluoride catalysts apparently permit the deposition of chromium with very little cathode film, or else the film redissolves in the solution rapidly, and this is probably a reason for the radically different results often obtained with such solutions as compared to those with a sulfate catalyst alone. Thus Shluger and Osbenkova [33] could see no cathodic film at all in 250 g/l CrO_3 solutions at 20°C with up to 30 g/l KF, while chloride and bromide additions gave visible cathodic films.

There seems to be some connection between the electrochemical behavior of chromium(III) salts and the properties of the corresponding anions as catalysts for chromium deposition from chromic acid solutions. Thus sulfate is the most complete and satisfactory single catalyst for chromic acid baths, and likewise chromium is being commercially deposited from chromium(III) sulfate-based baths for large-scale production of metal [34, 35].

Similarly, chromium(III) chloride can give good chromium deposition by itself [36], and chloride is an effective catalyst for chromium deposition from chromic acid, although the deposits are generally not bright. Unfortunately, chlorides break down at the anode with evolution of chlorine.

Levitan [24] showed that a chromium(II) compound is the primary reduction product at the cathode during chromium deposition, and investigated the further reaction products with chromic acid. He tried chromium deposition with 0.6 *M* chromous perchlorate solution added to sulfate-free, pure chromic acid solution, but no chromium deposit was obtained. Falicheva [37] attempted chromium deposition from chromium(III) perchlorate solutions, but only very thin coatings could be obtained.

Russian research [38, 39] shows that there is still disagreement regarding the mechanism of the electrodeposition of chromium, that the nature of the film formed at the cathode still needs to be determined, and that the connection between theory and practice is still inadequate. Other reviews cover deposition of both chromium and chromium alloys from chromic acid solutions [40] and from trivalent baths [41].

An unfortunate defect in much of the Russian work on the theory of

upper limit of current density for this bright plate range, the optimum throwing power will be attained.

In the conventional throwing power box, cyanide copper plating baths with good throwing power generally have a rating of around 20 to 40%, whereas most nickel plating and acid copper plating baths have a rating near zero. The throwing power in chromium plating has been found to vary from around -13% under the best conditions to -100% and even lower [13, 49, 52]. The relative throwing power of chromium plating baths is often estimated by an empirical test such as the Hull cell test, described in the next section.

HIGH THROW BATHS

High-ratio baths containing relatively high concentrations of organic acids have been developed [53, 54] which exhibit remarkable throwing power or covering power over bright nickel, almost as good as that of bright nickel baths themselves. These solutions operate at lower current efficiencies to produce thin bright plates of good decorative value. It is a characteristic that the coverage increases with time and the plate continues to spread into the low-current-density areas with longer plating. Thus plating times as long as 5 to 10 min are recommended instead of the 2 to 3 min often used for decorative plating.

METALLIC IMPURITIES

Cations that may commonly be present in chromium plating baths include chromium(III), iron, copper, nickel, zinc, and sodium. Chromium(III) usually results when baths are operated with too large a cathode area and too small an anode area, or when organic matter is introduced. The chromium(III) content can be kept down by increasing the area of the lead anodes used relative to the cathode area, or, where this is not practical, by electrolyzing the solution for a time with a relatively large anode area and a small cathode area.

Iron, copper, nickel, zinc and other metallic impurities may be introduced into the bath in various ways; if permitted to accumulate, they cause an increase in the resistivity of the bath. None of the cations discussed has any noteworthy beneficial effect on the operating characteristics of the bath. Chromium(III) particularly is detrimental, although contrary statements have appeared [55]. The tradition that a small amount of chromium(III) is beneficial when added to a new bath may have grown up due to making such additions in the early days in the form of chromic sulfate or chromium hydroxide precipitated from chromic sulfate and containing some sulfate, thus affecting the catalyst content of the bath. A number of very painstaking investigations have failed to indicate any improvement in new baths with the

addition of small amounts of chromium(III) and there is no need to electrolyze a properly made up new bath for this purpose.

MAINTENANCE AND CONTROL

Chromium plating baths are seldom filtered, although filtering has been recommended [56, 119]. If some clarification is desired, it can be accomplished by settling overnight and decanting. If desired, a chromium solution may be filtered through a pad of glass wool or through fiber glass filter cloth. Filtering cloths of Vinylite (Vinyon) and Saran are also available and have substantially complete resistance to chromic acid.

Chromium plating baths are very stable in use, and their composition can be readily maintained by physical or chemical analysis. Some of the chromic acid is reduced to chromium(III) whenever chromium is being plated, but this is continually reoxidized to chromic acid on the lead dioxide surface of the lead anodes commonly used. This automatically maintains the chromium(III) concentration at a relatively low figure under usual operating conditions, especially if the area of the lead anodes is sufficient [57]. If iron or other anodes are used for special purposes, they do not reoxidize the chromium(III) to chromic acid as well as do lead anodes, and a higher equilibrium concentration of chromium(III) is reached after the bath has been used for some time. Furthermore, these other anodes, unless highly insoluble like lead, introduce contaminating metals such as iron into the solution, and therefore should generally be avoided.

Wetting agents are frequently used to suppress the mist of solution carried into the atmosphere by the hydrogen evolution at the cathode, rather than to prevent pitting as in other plating baths. A great variety of wetting agents have been developed to minimize the fumes evolved during plating; the prospective user of such compounds should satisfy himself about their stability under his particular conditions. If they are used, surface tension measurements may become desirable for control, although visual observation of the fume suppression or amount of foaming may be sufficient.

Special physical measurements or plating tests are frequently made to check the condition of a bath or to determine the total caralytic effect of all the acid radicals present. Many plants use physical instead of chemical analysis as the basis for adjustments. Pinner and Baker [58] proposed a bent-cathode test to determine the ratio of chromic acid to total catalyst acid radicals. This was a modification of the strip test first used by Fink, described below.

Pfanhauser [59] developed a so-called potentiometric method of checking the approximate catalyst content. This consists of an ammeter and voltmeter connected to a small plating cell with a 4- or 5-V source of direct current and

a rheostat. The solution to be tested is placed in the cell with lead anodes and a brass cathode. The current is slowly raised until there is a sudden increase in voltage and a deposit of chromium appears. The current density at which this occurs is noted, and the catalyst content of the bath in terms of sulfate is estimated from current-voltage reference curves plotted for solutions of known composition. A special instrument for making these measurements has been marketed in Germany under the name L. P. W. Sulfometer [60]; the ammeter of this instrument is sometimes calibrated to read the ratio directly. Stalzer reviewed the use of this instrument in 1968 [61].

Perhaps the most important plating test used with chromium plating baths is the determination of the current efficiency under known conditions, as first used by Fink as part of his strip test. When carefully carried out, this measurement gives a great deal of information regarding the characteristics of a given bath and its total catalyst content. The appearance and distribution of the resultant plate under the test conditions can also be studied when data on current efficiency are being obtained. If the current efficiency is not required, the appearance of the plate at different current densities can be observed to better advantage in a single measurement by means of a Hull cell or other similar test [62, 63].

The specific gravity is a good indication of the chromic acid content with new baths, but may show considerable deviation as the bath is used and accumulates metallic impurities. Sulfate is often determined centrifugally, but this method is not always reliable. Excess sulfate is commonly precipitated by the addition of barium carbonate, but it can also be counterbalanced by the addition of chromic acid, if convenient.

Silicofluoride-containing chromium plating baths were found difficult to analyze and control. Many methods were proposed, but they were not generally dependable or accurate. Branciaroli and Coleman [64] give a better method for the total fluorine content. There is considerable confusion and inaccuracy in the literature about fluoride- and silicofluoride-containing chromium baths. Nevertheless, and in spite of the difficulties, present-day silicofluoride-containing baths with or without self-regulating features have more than compensating advantages.

SELF-REGULATING BATHS

An important development was the introduction of chromium plating bath systems called self-regulating high-speed, or simply SRHS,* baths. These are chromic acid solutions containing mixed and cooperating catalyst acid radicals (generally sulfate and silicofluoride) in concentrations controlled

*Trademark M & T Chemicals Inc.

PLATING, CHROMIUM ELECTRO

1. APPLICATION

1.1 This specification covers the requirements for the application of a wear resistant chromium deposit on steel, stainless steel, copper alloy, and nickel-plated parts. Chromium plating covered by this specification shall be of the following classes.

Class A - Parts plated to a dimension-plating thickness to a maximum of 0.002 inch.

Class B - Parts plated to dimension or ground to dimension after plating. Minimum plating thickness on finished parts to be 0.002 inch.

1.2 This specification covers the procedures and requirements for high-speed chromium baths. Other plating baths may be used, provided the requirements of this specification meets the performance requirements of QQ-C-320.

1.3 This specification shall be applicable when referenced on Engineering drawings, or when called out in applicable finish specifications.

1.4 This Revision H supersedes and includes Amendment Nos. 2, 2A, and 2B. Items marked ▌ are new or revised with this issue.

1.5 This revised specification is effective upon issue. It may be implemented at once but it must be implemented by 28 October 1987 Subcontractors or vendors performing processing in accordance with the requirements of the previous issue of this specification shall implement the changes defined herein with 90 days after receiving this document. If compliance with these changes cannot be effected within the designated lead time, a request for deviation must be submitted in compliance with P.S. 10000.

2. APPLICABLE DOCUMENTS

2.1 The following McDonnell Douglas (St. Louis) Specifications form a part of this specification to the extent referenced herein:

P.S. 10000	P.S. 12010	P.S. 12020
P.S. 12030	P.S. 12040	P.S. 12045
P.S. 12050	P.S. 13101	P.S. 14023
P.S. 15063	P.S. 20002	P.S. 21201
P.S. 21202	P.S. 23401	P.S. 23405

Refer to the Process Specification Index for a complete title and the latest revision information on each specification.

QQ-C-320 - Chromium Plating (Electrodeposited)

ASTM E292 - Conducting Time-For-Rupture Notch Tension Tests or Materials

3. MATERIALS AND/OR SOLUTIONS

3.1 Materials for solvent cleaning and/or vapor degreasing, P.S. 12010 and/or P.S. 12020.

3.2 Materials for abrasive cleaning and/or liquid honing, P.S. 12040 and/or P.S. 12045.

3.3 Materials for Type II Alkaline Cleaning, P.S. 12030.

3.4 Hydrochloric (muriatic) acid pickling solution, P.S. 12050.8.

3.5 MASKING MATERIALS

3.5.1 Tapes - Suitable Widths

(a) #470 Pressure Sensitive Tape - Minnesota Mining and Mfg. Company

(b) Miccrotape Miccrotube - Michigan Chrome and Chemical Company

3.5.2 Stop-Off Lacquers

(a) Unichrome Stop-Off - M&T Chemicals, Inc.

(b) Miccroshield - Miccro Products

3.5.3 Stop-Off Waxes

(a) Miccrowax - Michigan Chrome and Chemical Company or equivalent

3.5.4 Plugs and Stoppers

3.5.4.1 Rubber or plastic - suitable sizes - commercial

3.6 CHROMIUM PLATING SOLUTION (SELF-REGULATING, HIGH-SPEED)

3.6.1 Solution Make-Up - The self-regulating, high-speed chromium plating bath shall be made up in accordance with Table I.

CHEMICAL	QUANTITY	TEMPERATURE
CR-110 Salts*	2.4 lb.	132 ± 5°F
Tap Water	1 gal.	
Lead-tin or lead-antimony anodes		
*Available from M&T Chemicals, Inc.		

TABLE I - CHROMIUM PLATING BATH MAKE-UP

3.6.1.1 Fill tank about two-thirds full with water (deionized water preferred), and heat to about 140°F.

3.6.1.2 Add and stir in the required amount of CR-110 Salts as shown in Table I.

3.6.1.3 Add water to bring to operating level and stir thoroughly for at least one hour.

NOTE: Do not attempt to completely dissolve all salts. A certain amount will and should remain undissolved.

3.6.1.4 Adjust temperature controller and bring within operating range.

NOTE: The chromium plating bath should not be heated over 150°F.

3.6.1.5 Place anodes in the tank, and using dummy steel cathodes, electrolyze at 6 volts for about 2 hours.

3.6.2 Solution Control

3.6.2.1 The chrome plating solution shall be controlled within the limits shown in Table II as required by 7.2.2.

CHEMICAL	CONCENTRATION	OPERATING TEMP
Chromic Acid CrO_3	30-33 oz./gal.	132 ± 5°F
Sulfates (as H_2SO_4)	0.12-0.15 oz./gal.	
Chloride	0.003 oz./gal. (max.	
Trivalent Chromium	0.5 oz./gal. (max.)	
Iron	0.5 oz./gal. (max.	

TABLE II - CHROMIUM PLATING BATH CONTROL (UNICHROME CR-110 BATH)

3.6.2.2 The chromic acid concentration shall be analysed using a conventional volumetric oxidation-reduction procedure for hexavalent chromium. To increase the chromic acid concentration by 1.0 oz./gal. add 1.1 oz./gal. of CR-130 or CR-140 (available from M&T Chemicals, Inc.).

3.6.2.3 The chromic acid concentration may be measured on a daily basis by the use of a hydrometer calibrated in degrees Baume'. Figure 1 shows the relationship between solution density in degrees Baume' and chromic acid concentration at 130°F.

NOTE: Through use the bath will become contaminated with heavy metals which will increase the solution density. Chromic acid concentration determinations by hydrometer should occasionally be compared to analytical results to establish the increase in density due to heavy metals.

3.6.2.4 Barium carbonate may be added directly to the plating bath at operating temperature to lower the sulfate concentration. For each 0.01 oz./gal. of sulfate to be lowered, 0.02 oz./gal. of barium carbonate should be used.

3.6.2.5 Plating bath volume losses due to evaporation should be replaced by deionized water.

3.7 REVERSE-ETCH SOLUTION

3.7.1 Solution Make-Up - The reverse-etch solution make-up shall be the same as the high-speed solution in 3.6.1.

3.7.2 Solution Control - The chromic acid (CrO_3) and the iron concentrations shall be controlled within limits specified in 3.6.2.

3.8 ANODIC ETCH SOLUTION

3.8.1 Solution Make-Up - The anodic etch solution shall be made up in accordance with Table III.

CHEMICALS	CONCENTRATION	TEMPERATURE
HF - Tech (70% HF) O-H-795	4% by volume	Ambient
H_2SO_4, (66° Be') Type I, Class I O-S-809	25% by volume	
Water	Remainder	

TABLE III - ANODIC ETCH SOLUTION

3.8.1.1 Fill the tank to the half full with tap water.

3.8.1.2 With mild tank agitation, slowly add sufficient sulfuric acid and hydrofluoric acid to meet the concentration requirements of Table IV in the final bath volume.

3.8.2 Solution Control The anodic etch solution shall be controlled within Table IV operating limits.

CHEMICAL	CONCENTRATION
Sulfuric Acid	20 to 30% by volume
Hydrofluoric Acid	3 to 5% by volume

TABLE IV - ANODIC ETCH SOLUTION CONTROL

3.9 STRIPPING SOLUTION

3.9.1 Solution Make-Up - The chromium plate stripping solution shall be made up in accordance with Table V.

CHEMICAL	CONCENTRATION	OPERATING TEMP
Alkaline Electro-cleaner	8-10 oz./gal.	70 - 140°F
Sodium Hydroxide	4-6 oz./gal.	

TABLE V - CHROMIUM PLATE STRIPPING SOLUTION

3.9.1.1 Fill tank about two thirds full of tap water. Add required amounts of chemicals in conformance with Table V based on final bath volume.

3.9.1.2 Stir until chemicals are completely dissolved.

3.9.1.3 Add water to bring solution to operating level and heat to desired temperature. Solution temperature of 140°F is desired for more rapid stripping.

3.9.2 Solution Control - The stripping solution shall be controlled within limits specified in Table V.

4. EQUIPMENT

4.1 Solvent and/or vapor degreasing equipment required by P.S. 12010 and/or P.S. 12020.

4.2 Alkaline cleaning equipment required by P.S. 12030.

4.3 Abrasive cleaning and/or liquid honing equipment required by P.S. 12040 and/or P.S. 12045.

4.4 Hydrochloric (muriatic) acid pickling equipment required by P.S. 12050.8.

4.5 Ovens for stress and embrittlement relief of steel parts. Ovens operating up to 300°F shall meet requirements for Class 3 systems for P.S. 23401. Ovens operating at temperatures over 500°F shall meet requirements for Class 2 systems for P.S. 23401.

4.6 Copper or brass hooks, racks, and wire for suspending parts in solutions.

4.7 Reverse etch and/or anodic etch tank and associated equipment including lead-lined or Koroseal-lined steel tank, heating coils, temperature controller, lead-tin or lead-antimony cathodes, copper anode and cathode bars, filtered compressed air agitation and a D.C. power supply.

4.8 Chromium plating tank and associated equipment including lead-lined or Koroseal-lined steel tank, lead or tantalum heating coils, temperature controller, lead-tin or lead-antimony anodes, copper anode and cathode bars, filtered compressed air agitation and a D.C. power supply.

4.9 Steel tank for cold water rinse after plating.

4.10 Steel tank for hot water final rinse.

4.11 Steel stripping tank equipped with heating coils, temperature controller, copper anode and cathode bars, steel cathodes, and D.C. power supply.

4.12 Filtered compressed air drying equipment.

5. REQUIREMENTS

5.1 PROCESSING REQUIREMENTS

5.1.1 All brazing, welding, forming, heat treating, and shot peening shall be done on parts before chromium plating. When shot peening of steel parts is required, stress relief shall be done prior to the shot peening.

5.1.2 Steel parts Class A or Class B which are plated to final dimensions shall have a surface finish prior to plating that is equal to, or better than, the required finish after plating. When the surface finish of the chromium plate on such parts is not specified on the drawing, it shall be equal to, or better than, the surface finish specified for the base metal.

5.1.3 Prior to plating, steel parts having a tensile strength greater than 180 ksi which are subjected to machining, forming, or grinding following heat treatment, shall be stress relieved per P.S. 15063.

5.1.4 After plating, steel parts shall be embrittlement relieved per P.S. 15063. Embrittlement relief shall be started within 4 hours after plating. If embrittlement relief is not started within 4 hours, parts shall first be embrittlement relieved and then be magnetic particle inspected per P.S. 21201.

5.1.5 After plating and embrittlement relief, steel parts, not including ground support parts, which are specified in the following list shall receive magnetic particle inspection per P.S. 21201. This inspection may be performed with other magnetic particle inspections or be performed for final part acceptance.

(a) PH13-8 Mo H900-H1000 (> 200 ksi)

(b) 4330V (> 200 ksi)

(c) 4340 (> 200 ksi)

(d) HP9-4-30 (> 220 ksi)

(e) 300M (> 280 ksi)

5.1.6 Auxiliary lead anodes shall be used for plating in holes, recessed areas, or other difficult hard-to-plate areas, when called out by Engineering drawing or other applicable specification. These anodes shall be of such size and shape commensurate with area being plated. Additional solution circulation into small and deep holes or recesses may be necessary.

5.1.7 Parts should be continuously plated to prevent delamination of the chromium deposit. If parts are pulled from the tank for dimensional checks and plating must be continued, follow the Current Interruption to Measure Dimensions Procedures listed in 6.10.

5.1.8 Parts having chromium deposits that do not meet finish requirements, shall be stripped of chromium and then replated.

5.1.9 Parts which have been removed from the plating tank and are dry and have insufficient plating or are dimensionally under size shall be stripped of chromium and then replated.

5.1.10 Parts requiring chromium and cadmium plating shall be plated first with chromium.

5.1.11 All unplated areas of steel parts shall be protected as soon as possible after plating with rust preventive compound or primer in accordance with the applicable finish specification.

5.2 TEST SPECIMEN REQUIREMENTS

5.2.1 Adhesion test panels shall be 4130 or 4340 steel, approximately 1 inch x 4 inches x 0.040 inch.

5.2.2 Test specimens for evaluation of hydrogen embrittlement relief shall be made of material which is identical in type and heat treatment to the production material, or the specimens shall be made of 4340 steel conforming to MIL-S-5000 or AMS 6414, heat treated to 260-280 ksi ultimate tensile strength. These specimens shall conform to either MCAIR Std. 6M114-1 or ASTM E292 configuration, with 0.010 ± 0.0005 inch notch root radius. The specimens shall be plated to a deposit thickness of 0.0015-0.0030 inch.

5.3 PLATING PROPERTY REQUIREMENTS

5.3.1 General Appearance

5.3.1.1 The as-plated chromium deposit shall be smooth, continuous, adherent and free of blisters. Cracking in the as-plated chromium that can be seen with the unaided eye shall be cause for rejection. A uniform satin lusterless finish is acceptable. The additional requirements specified below shall be met as applicable.

5.3.1.1.1 Parts plated to dimension - The as-plated chromium shall be free of pits, nodules and frosty burned areas.

5.3.1.1.2 Parts to be ground to dimension - Pits having a depth that does not penetrate the final thickness or radius of the part and can be removed by grinding are acceptable. Frosty burned areas which will be removed by grinding are acceptable.

5.3.2 Plating Adhesion

5.3.2.1 Adhesion tests shall be made by bending test panels through an angle of 180° on a diameter equal to the thickness of the panel, straightening, and then examining at four diameters magnification. The coating shall be adherent and show no separation from the base metal. Formation of cracks in either the base metal or in the plating, that does not result in flaking or peeling of the plating shall not be cause for rejection.

5.3.3 Plating Thickness

5.3.3.1 Thickness of chromium plating shall be specified on the Engineering drawing or other applicable document.

5.3.4 Embrittlement Test

5.3.4.1 Four specimens conforming to the requirements of 5.2.2 shall be embrittlement relief baked in accordance with P.S. 15063, loaded in tension to 75 percent of the predetermined notch tensile ultimate strength and held at this load for 200 hours. The samples shall be considered nonconforming if any specimen fails by fracture or if any specimen is cracked. Specimens shall be inspected for cracks by penetrant inspection per P.S. 21202.

5.3.4.2 Nonconformance of any test specimen shall result in red-tagging of the tank, and no further plating work shall be conducted until resolution of the operating problems. The embrittlement relief test shall be repeated immediately.

5.4 CHROME PLATE RUN OUT

5.4.1 When chrome plate is applied to fatigue critical or fracture critical parts so designated by the Engineering drawing, and to high strength steel, the chrome plate termination shall consist of a run out within a distance specified upon the Engineering drawing.

5.4.2 The term, "run out", describes the transition of the plating thickness from its finished, ground surface to its termination. (Run out shall be synonymous with other descriptive terms, such as bleed out, feather out and fade out.) Run out is the decrease in plating thickness that takes place in a gradual, uniform manner to result in a tapered edge. The shape of the taper may be straight, or mildly convex, or mildly concave. Steps are not acceptable. Refer to Figure 2 for examples of acceptable run out.

5.4.3 The preferred method for accomplishing chrome plate run out is through proper masking and robber techniques during the plating process. However, run out may be accomplished by careful machine grinding, provided the plating thickness is .002 inch, or greater. Care must be taken to avoid overheating and/or grinding into the steel substrate. The shot peened surface shall not be disturbed.

5.4.4 Additional corrosion protection is required on the thinned out chrome and any bare steel remaining in the run out area. This area shall be brush plated using low embrittling cadmium plate per P.S. 13113 or other coating specified on the Engineering drawing. This protection is not required for parts immersed in hydraulic oil.

6. PROCEDURES

6.1 Solvent clean or vapor degrease parts in accordance with P.S. 12010, or P.S. 12020 to remove oil and grease.

6.2 Stress relieve steel parts in accordance with requirements of 5.1.3.

6.3 Remove scale and corrosion products by abrasive cleaning in accordance with P.S. 12040, or by liquid honing in accordance with P.S. 12045.

6.3.1 Shot peen steel parts, as specified by Engineering drawing.

6.4 Mask areas which are not to be plated with rubber stoppers, rubber masks, tape, or lacquer. Before dipping parts in wax or spraying them with lacquer, cover any surfaces that are to be plated with aluminum foil or tape to prevent contamination by wax, lacquer or other contaminants.

6.5 Attach parts to racks or fixtures making certain that good electrical contact has been made.

6.6 Alkaline clean parts in accordance with P.S. 12030, type as applicable for substrate.

6.7 Pre-Plating Activities

6.7.1 Ferrous Alloy and Stainless Steel Parts - Anodic etch parts in the "Reverse etch" solution conforming to 3.7 at 1-3 amperes per square inch using a voltage range of 4-6 volts. Parts made of 4130, 4340, or 300M steel shall be etched for 3-5 minutes. All other steel parts shall be etched for 30-120 seconds. Rinse and transfer them to the plating tank immediately. When parts are reverse etched in the plating tank, rinsing and transfer of the parts is not necessary.

ALTERNATE: Activate the parts by anodic etching for 60 seconds ± 15 seconds in the anodic etch solution (3.8) using a current density range of 4-6 amperes for each square inch of exposed metal; rinse and plate immediately.

6.7.2 Nickel-Plated Parts - Immerse the parts in the 60% hydrochloric acid solution (P.S. 12050.8) for 15 - 30 seconds; rinse and plate.

ALTERNATE: Activate the parts in the Table III anodic etch solution for 60 second ± 15 seconds using a current density range of 4 - 6 amperes for each square inch of exposed metal; rinse and plate immediately.

of standard articles, and particularly where automatic plant is concerned, it is possible to make a fair estimate of the quantity of chromic acid to be added at regular intervals to maintain the concentration. However, the additions should be somewhat less than those required theoretically and the balance made up only after chemical analysis has confirmed the quantity required.

Trivalent Chromium

Chromic acid is reduced at the cathode to the trivalent state, but as this product is oxidised to chromic acid at the anode, an equilibrium becomes established. The concentration under equilibrium conditions depends mainly on current density and the ratio of the cathode and anode areas. If the effective anode area is greater than the cathode area, the trivalent chromium concentration remains low. If, on the other hand, due to the shape of the part for deposition, as, for example, in internal deposition, the anode area is small, or if the anodes are not properly maintained then the trivalent chromium concentration may become quite high.

As a general rule, the concentration of trivalent chromium should not exceed 1½ oz./gal. Concentrations greater than this may cause pitted deposits.

The colour of the solution is a good indication of the trivalent chromium content. If the solution is transparent and orange in colour, the trivalent chromium concentration is low. If, however, the solution is opaque in thin layers and has a greenish hue, it can be assumed that the trivalent concentration is high. The necessity for chemical analysis can be judged by these means, but in any case an exact analysis should be carried out every three months.

The Dechromator

As already stated, the concentration of trivalent chromium in the solution depends on the respective areas of the cathode and anode. By careful arrangement of the sequence of work treated, alternating work requiring a small anode area with work requiring a large anode area, it is usually possible to maintain the concentration at a suitably low level. If this cannot be arranged, trivalent chromium can be oxidised back to chromic acid in the solution by the "porous pot" method (Dechromator). This comprises a small cathode in a porous

container of unglazed earthenware which is hung on the cathode bar while the solution is worked at high current density and with a large anode area. The trivalent chromium in the bulk of the solution is oxidised to chromic acid whilst that formed at the cathode is retained in the pot. When the resistance of the solution in the pot becomes too high for satisfactory working it is discarded, and the operation is repeated, if necessary.

Although widely used, it is not entirely satisfactory except, perhaps, for small installations, since the liquid inside the pot tends to bubble over partly as a result of the tremendous gas evolution and partly through actual boiling resulting from the high current densities employed, so spilling back trivalent chromium into the bulk of the solution.

Another method (Seegmiller and Lamb[354]), which avoids the use of a porous pot, is to work the solution at a high temperature (175°F.) with a high cathode current density (550-600 amp./sq. ft.) and a low anode current density (18-20 amp./sq. ft.). A steel rod can be used as cathode in conjunction with an antimonial lead anode having an area at least thirty times as large as that of the cathode.

Fig. 202.
Dechromator employed to reduce trivalent chromium concentration.

The following numerical example indicates the speed of oxidation obtained in this way. Using a current of 6 amp./gallon of solution, a cathode current density of 550 amp./sq. ft. and an anode current density of 18 amp./sq. ft., the trivalent chromium concentration was reduced from $3\frac{1}{2}$ oz./gal. to $\frac{3}{4}$ oz./gal. in :

22	hours	with	solution	temperature	175°F.
41	,,	,,	,,	,,	120°F.
126	,,	,,	,,	,,	70°F.

Sulphuric Acid

The sulphuric acid concentration may decrease due to spray loss and drag-out of solution or it may increase due to sulphuric acid carried over from the etching solution or to its presence as an impurity in the chromic acid additions which are made periodically. If the parts treated have a complex shape, the greatest effect will be due to the acid carried over from the etch, and the sulphuric acid concentration of the solution will gradually increase.

The sulphuric acid content desired depends essentially on the content of chromic acid. The ratio $CrO_3 : H_2SO_4$, usually approximately 100:1, should not vary by more than 10-20 units from the value originally fixed. It follows, therefore, that the sulphuric acid concentration should be checked each time chromic acid is added to the solution.

If the sulphuric acid concentration is too low, the necessary extra quantity of sulphuric acid can be added as such. If the concentration is too high, the excess can be eliminated as barium sulphate by addition of barium carbonate or hydroxide. Approximately 2x oz. of barium carbonate or hydroxide are required to remove x oz. of sulphuric acid.

The reactions involved in the removal of sulphuric acid are probably as follows :

$$Ba(OH)_2 + H_2CrO_4 \rightarrow BaCrO_4 + 2H_2O \quad \ldots\ldots\ldots\ldots \quad (1)$$
$$BaCrO_4 + H_2SO_4 \rightarrow BaSO_4 + H_2CrO_4 \quad \ldots\ldots\ldots\ldots \quad (2)$$

Reaction (1) will take place immediately on addition, but reaction (2) will progress much more slowly as barium chromate is almost insoluble and will remain on the bottom of the vat. In order to increase the speed of reaction, it is preferable to fill the calculated

HARD FACTS ABOUT HARD CHROME

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XVII—Replating

85% good information but still some is questionable in my opinion.

The word "replating" should mean only one thing — putting another layer of chrome on an existing deposit. It's a no-no to say you are going to "strip and replate a piece." The correct terminology is "strip and plate," a procedure which can save a lot of confusion around the shop. There is also a lot of confusion about how to replate different thicknesses of hard chrome properly. It's not surprising that there are several schools of thought as to the best procedure. Unfortunately one of them is avoid doing it like sin. To *strip and plate* instead of *replating* hits you where it hurts — in the balance sheet at the end of the year.

When replating is done correctly there should be no difference in the layers and grinding through the bond zone should not be noticeable. Some shops call replating "laminating," which is also a bad term. I don't *laminate* and *neither should you*. The word "laminating" suggests two distinct layers, and is terrible public relations. As far as the public is concerned, they know laminating to mean distinct layers with a binder or space in between. **Even if the piece is replated two or more times, the final result should be a solid deposit of chrome.**

In the METAL FINISHING GUIDEBOOK section on replating chrome, a method is described that gives good results under some conditions but, unfortunately, poor results in others. There are too many variables that affect the outcome to have a simple rule for everything. Some of the variables are chrome thickness, whether the surface is newly plated or ground, or a surface used in service. Other variables are anode condition, part of the surface left unplated, surface on finish size, spot plating, surface ground or plating worn through in spots, and base material.

All dictate the procedure to be used. The situation is not as bad as this sounds, but it will require a few decisions. First we tackle the basic procedure, which will cover about 75% of the replating jobs, then we take up the rest.

In all cases we want the plating to continue just as it left off. This means a warm-up period in the tank, to get the workpiece up to tank temperature. While you can plate on a chemically clean surface, an etched surface is better. **Any surface that has more than 0.0015" (0.038 mm) thick chrome should be reverse etched for three minutes, after warm up, at the regular running voltage of the tank. This will remove about 0.0005" (0.013 mm) of the chrome surface and lightly etch it.**

Good

If reverse plating (etching) is allowed to continue much beyond this time the chrome will either be removed entirely or in spots, or be badly etched, which will show in the new layer of chromium. Which of these nasty things happens will depend on the chrome thickness and condition. The three-minute mark for anodic treatment in the chrome plating solution has stood the test of time of over 40 years of replating. Yes, there are exceptions, so watch for them down the page.

Because you are removing a 0.0005" (0.013 mm) thick chrome layer, it isn't necessary to go through any involved cleaning process. You don't need an electrocleaner, which is expensive to maintain and will slow you down. Wipe the surface with lacquer thinner and whiting powder, rubbing to remove grease and oil or other foreign matter on the surface. If the part has been used, a greaseless polishing or glass beading treatment may be in order. Get the surface clean and, even more important, keep it clean! Don't lay the workpiece on a dirty bench or scrape it on the anode when reracking it. If you get into any other involved cleaning procedure you wind up with unnecessary equipment, excessive water use, and chemical disposal problems. The wasted time and effort can be better spent on something more productive.

Warm-up time is five to 30 minutes, the actual period depending on the mass of the part. In any case, never warm up the part longer than 30 minutes. Parts heat up very quickly when immersed in a solution. So now you have warmed the piece up and reversed it three minutes. As soon as it hits the three-minute mark cut the voltage down to three volts, then *turn* the rack around to plating position. Slowly **bring the voltage up to plating voltage, but take no longer than one minute to do this.** ***I mean one minute absolutely, positively***, so watch the clock!

Good

The reason for the cut voltage is as follows. Especially with conforming anodes and high plating rates, the anode will plate in the reverse

The remove overplating by reverse etching for 15 minutes the replated be rescued.

cycle. This chrome will be plated very rapidly on the high current density areas when the rack is placed in the plating position. If the voltage is lowered at the start, the chromium will deposit on the piece at a more normal rate. Taking one minute to bring the voltage up is more than long enough to deplate the anode. More than one minute wastes time and may induce gas bubble pitting.

Some people recommend taking 10 minutes to bring the voltage up. If your labor is worth 50¢ a minute, a little head math will tell you what this wasted time costs, and believe me, it *is wasted*. To make up for the removal of 0.0005" (0.013 mm) thick chrome plus slowing down of the anode, which occurs when the anode is dormant in the tank, it will be necessary to add ½ hour to the running time.

Good

If you are looking for these replate racks to be vigorously gassing at the end of three minutes reverse, forget it. Some will and some will not. This is not a reliable indicator that the piece has had the proper reverse treatment. How much gassing you will see is determined by several factors, such as the age and condition of the anode. A new anode will hardly gas at all while older ones gas at a variable rate as they reform.

The condition of the chrome plate also has an effect. If you replate a piece that has been just pulled out of the tank, it will begin gassing vigorously (whatever that means) in less than 30 seconds. If it's turned around with less than 30 seconds reverse, it is very likely to peel immediately or in the grinding operation. The three minutes reverse takes into account the variables for the heavier chrome deposits. You can get in trouble with large pieces that have poor contact, connections, not enough anode, and slow plating rates. Reverse will also be slow, so use four or five minutes for these. What I am saying is that you are not supposed to be plating like that anymore!

When running pieces in conforming tank anodes, it's easy to lift them and check them for size. Subtract 0.0004 (0.01 mm) per inch of piece diameter for shrinkage from 140°F (60°C) to room temperature to get the correct size while hot. Do not rinse it off, and if after a quick check it still needs more chrome, drop it back in the anode. You must reverse it again for three minutes to insure that it will not peel.

There is always some oil floating on the tank which could adhere and cause peeling if it isn't removed by reverse treatment. At that stage of the game it doesn't pay to take chances. A large shaft or roller out of the tank a *few minutes* doesn't need a warm up. It will take you about five minutes to get it started again, which is enough to bring it back to running temperature.

When replating thin deposits under 0.0015" (0.038 mm) thick you have a whole new ball game. Reverse times have to be shorter to prevent partially or sometimes entirely removing the existing plate. If the material is low-carbon, low-alloy steel, reversing the plate off may be the thing to do. If you reverse the plate off high-carbon, high-alloy steel, or other materials it may be *rejectsville*. Steels that can tolerate only less than one minute reverse will probably misplate where the chrome is entirely stripped off. Of course, other materials that can't stand any reverse will be a total loss if the chrome breaks through.

To avoid these problems, reverse treatment after the warm up can be from ½ to two minutes and, in special situations, no reverse at all should be done. Jobs we are talking about now would be *other than plus grind pieces*. Because of the shorter reverse times it will be necessary to clean the surface more thoroughly and maintain it in a no waterbreak condition.

For the beginners, if a surface is totally free of oil, grease or tallow, water will spread over it in a thin, uniform film. The water will bead up or refuse to cover the surface where any of the just-mentioned soils are present. To clean a surface to a waterbreak-free condition it can be scrubbed with caustic solution from the electrolytic strip tank and pumice powder. You can also use scouring powder purchased from your local grocery store. Most brands have grease-dissolving and wetting agents in them already.

I have mentioned the everpresent oil slick on the surfaces of chrome solutions. Now comes what to do about it. When putting in this type of replate work, it should go in between working racks or at the end of the tank where air agitation bubbles are coming up. You will find no oil slick at these places. A dry surface will pick up oil easier than a wet one. Putting the piece in while wet with water also helps.

How much reverse you should use will depend on the thickness of the existing chrome deposit. A rule of thumb is that you will remove 0.00015" (0.004 mm) thick chrome per minute after the warm-up period. Experience has also shown that if you are going to reverse the work at all, the minimum time is 30 seconds. To be on the safe side you would only want to remove no more than 20% because some areas may reverse faster than others.

You don't have to carry this out to the last decimal point. Close enough would be: two minutes for chrome between 0.001 and 0.0015" (0.025 and 0.038 mm), one minute for 0.0005 to 0.001" (0.013 to 0.025 mm) and 30 seconds for unde 0.0005" (0.013 mm) after warm up. I had you fooled there for a minute. I bet you thought this was going to be complicated. you will be replating either thin or thick deposits and just about nothing in between.

There are several situations where no reverse treatment before replating is called for. One of these is a hold-to-size job that comes out a few tenths light. When you unrack any job, treat it as if it will have to go back in the tank. This means don't scrape the anode, remove the holding bottom or tear off the stopoff before checking the piece for size. Keep it clean, wear gloves so you don't fingerprint it and don't lay it on a dirty bench. Remembering this will save you a lot of time and trouble.

To add a little more chrome to the piece, warm it up with only the cathode hook insulated. If the anode works off the other racks, it won't slow down, so it will be easier to figure the additional running time. Keep warm-up time as short as possible, which would be about five or 10 minutes for small pieces.

...If you have kept the piece clean, and put it back in the tank in an area where there is no oil slick, it will not peel and the plating will be satisfactory. I have used this procedure on pieces that have gotten very rough treatment, with no failures in use. In this case you are replating on a chemically clean surface. A point I may not have made clear is that I always reduce the voltage on every replate job before the piece starts plating again.

Another no reverse situation is a 0.0003 to 0.0005" (0.008 to 0.013 mm) thick flash job that misplates (i.e. has unplated areas) in some area. By moving the anode closer, or adding more anode area and running it at higher voltage a minute or two, the unplated area can be made to plate. Here again, keep the piece clean and get it back in the tank as soon as possible. If you haven't tried to clean, polish or reverse etch, it will be very difficult to see where the missed spots were. If it is a mirror finish job, they will buff out with the rest. If you decide to change the anode and only spot plate the miss, it will be very important to enter the tank where there is no oil slick. Failure to do this will result in rainbow colors all over the chrome on areas away from the anode.

When flash plating, you can run into the situation where you have misses caused by scale left on the workpiece. Glass beading and re-entering the tank at 3V, then bringing the voltage back up, will get them covered. You may have to replate a piece that has copper or brass showing. Warm it up with the anode hook tagged and the cathode hook working on the cathode bar. *This applies to reversible racks only!*

As long as copper or brass has voltage applied, it will not eat up. Keep the warm-up time short and reverse only 30 seconds. I have spot replated many pieces that were on finish size. When the spot plated area was ground to match the other chrome, you couldn't see where it was. While this is truly replating, the success or failure depends more on the stopoff method. It is necessary to border the area to be spotted with plastic tape or lacquer if tape isn't practicable. Aluminum tape should be positioned ¼" back from the plastic tape edge. If foil tape is allowed to border the area, reverse treatment will pull some chrome from under the foil tape and it will never plate back. Therefore, when the spotted area is ground, a groove will remain around the area. The plastic tape edge prevents this from happening.

Pieces that have ground-through or worn-through chrome in spots can present a problem. The ground-through area is going to look different from the chrome coated area and there will be a border area that is a combination of both. The border area can look pretty sad, and its width will depend on the thickness of the chrome layer. If you are asked to plate a piece like this to size, you can't strip it first, since this would make it out of round. It would be wise to replate it to the high side or slightly over, to allow polishing out the border area.

Knowing how to replate saves a lot of time, and time is about 95% of what you have to sell. If you strip and plate you waste the strip time, polish or polish-buff, or glass bead time, stop off and rack time. All of this can add up to many hours — expensive hours. You can hard chrome plate using any of the following types of bonding on either new or chromed surfaces: chemical, mechanical, etch bond, or some combination of the three.

For replating, a chemical bond is adequate for thin deposits not subject to high shock loads. Reversing the chrome layer produces an etched surface and the result is a combination of all three types of bond. If there is a failure, it will be the result of the first layer of chrome not being applied correctly. This in turn is usually caused by using an incorrect reverse treatment. This eases us into next month's article, titled "Reverse Cycles." MF

Correction

Very rarely do "gremlins" take over in laying out figures and captions for the articles. In fact, we cannot remember the last time it happened, but we regret that an error was made in the article by Robert D. Wyvill entitled "The Importance of Scab Corrosion Testing" in the January 1982 issue. The captions for photomicrographs 4B and 4C were transposed on page 23.

Additionally, the table under Fig. 6, below, belongs with Fig. 5.

Element	*(5A) Modified Process (Spray)*			*(5C) Conventional Process (Spray)*		
	Energy Dispersive X-Ray Analysis					
	Weight Percent			*Weight Percent*		
	$\bar{x}$	σ	$\sigma/\bar{x}$	$\bar{x}$	σ	$\sigma/\bar{x}$
Fe	78.0	0.3	± 1%	63.3	0.7	± 1%
Zn	13.5	0.3	± 2%	21.0	0.6	± 3%
Fe/Zn		6.0			3.0	

The two tables below should have appeared as part of Fig. 6 on page 24.

Final Rinse	*Conventional Process: Spray* Corrosion to Scribe	*Cross Hatch*	*Conventional Process: Immersion* Corrosion to Scribe	*Cross Hatch*
20	1.5 mm	7	<1.0 mm	9
18	<1.0	7	<1.0	9
15	<1.0	6	1.0	9

Final Rinse	*Conventional Process: Spray* Scab Corrosion Total Width	*Cross Hatch*	*Conventional Process: Immersion* Scab Corrosion Total Width	*Cross Hatch*
20	7.0 mm	7	2.0 mm	9
18	8.0	7	2.0	9
15	5.0	8	3.0	9

We apologize for any inconvenience caused our readers by this error.

HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger, Hard Chrome Plating Consultants Ltd., Cleveland, OH

Bright Range—The Total Picture

If you were to plate three lots of pieces, one lot at 130°F, one at 140°F, the other at 150°F, and each piece in a lot was plated a little faster than the others, the brightness of the chrome deposits would vary, as shown in Fig. 1. The three curves in the drawing may not be precise but they are accurate enough.

There could be variations caused by the type of chrome solution, concentration differences, chromic acid-to-catalyst ratio, and anode-to-cathode ratio. In any case, there is such a vast difference in the width of these curves that nit-picking will not be allowed!

For those of you who are current density happy, each curve starts out with the lowest density possible to plate, which produces a very milky plate. As the current is raised, for each succeeding piece, plating gets brighter to a maximum then falls off to badly burnt plate. Both the 130°F and 150°F curves are extremes and shouldn't be used.

Unfortunately, most of the world's hard chrome shops have been trapped into using 130°F hard chrome plating solutions. The cost of this mistake has been untold billions of dollars wasted on excess labor, materials, chrome, energy and plant size.

The 150°F curve looks great but there are serious disadvantages to using this high a temperature. Most tank linings are short-lived including lead, and anodes suffer the same fate. Because of the high voltage and currents necessary to plate 0.010" to 0.012" per hour, contacts and the ability of the part plated to carry the current become critical in a hurry. Large parts would need huge rectifiers to supply the necessary current.

I know of one captive shop that is plating air hammer cylinders 0.012" per hour in the ID at 150°F, but that is all he plates. Most of you have job shops and it's necessary that you be able to plate holes and slots 0.040" in diameter along with large pieces in the same tank at the same time using one rectifier. The hole in this "o" is about 0.040" in diameter.

This is also not very feasible in a 130°F tank, besides all the other horrendous disadvantages. In 1945 I started writing a hard chrome plating book, and actually wrote five pages until I said to myself, "Hell, everybody knows how to hard chrome plate."

It wasn't until 1973 that I found out how wrong I was. On my vacation that year I passed a plating shop in North Carolina. I turned around and went back to see how they were doing. What a shocker that turned out to be! They were trying to hard chrome plate some shafts in what looked like a bright chrome tank.

Over in a corner I noticed some tools, molds, and dies and I asked the foreman when and where he was going to plate them. He answered, "We are not going to plate

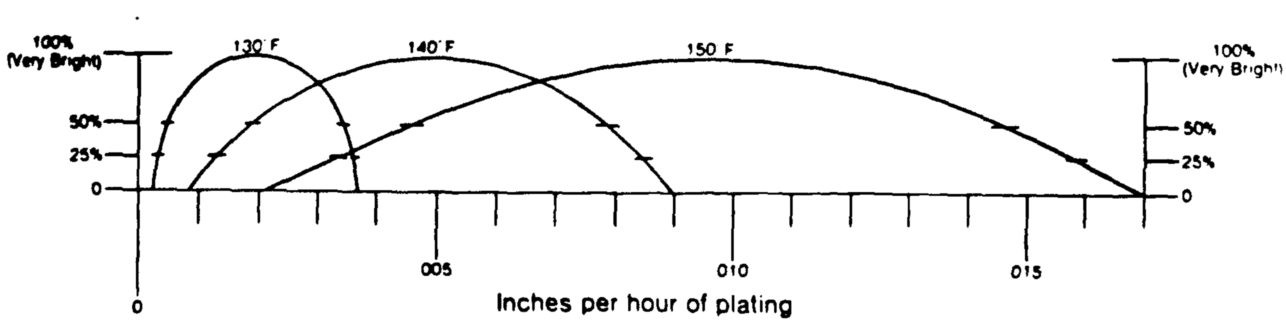

Fig. 1. Milky plate left side of curves up to the 25% point. Burnt plate right side of curves down from the 25% point.

them; they will stay there until the customer gets mad and takes them away."

A stop at three more shops turned up pretty much the same story. Upon returning home I started writing the book that should have been written 28 years earlier.

Of course these shops and probably yours are suffering from the plating by amps, 130°F syndrome. Believe me, it's not the way to plate! A look at the 130°F curve will show you why. If you don't plate at a 2 Amps per sq in (ASI) rate you're quickly in trouble. At 1 A, the piece comes out milky; at 4 A they burn up.

As if that isn't enough, the whole method is rotten to the core. At 130°F and 2 ASI, you're always fighting high trivalent levels by dummying the tank (you can't sell the dummy rods!) or worse yet, throwing out the solution! Shafts come out with too much chrome on the ends and not enough in the middle. Large flats only plate on the edges; zilch in the middle.

Have you stopped and figured out how much it really costs you and the customer to plate and grind this sloppy work? There is a long list of other bad things you have to contend with if you are plating that miserable way. Of course, how would you know if you have never seen a shop that plates at 140°F, 0.002" to 0.006" per hour rates and uses the reversible rack system.

Notice in the 140°F curve that you can plate anywhere between 0.002" and 0.006" per hour and have an acceptable hard chrome plate. I have been plating this way all my working life (since 1941 to be exact), and it's no pipe dream. There are virtually no disadvantages to plating this way. You don't abuse the solution or equipment, you get 3 to 4 times more work out of a tank, and at least twice as much productivity out of a plater. If you can't equate these things with more money in the bank and happier customers there is no hope for you!

What gets me and your customers mad is that most of you are not shaping up (look at the drift to captive shops). Ninety percent of you really don't know how to hard chrome plate and the other 10% have a lot to learn. Slopping chrome on pieces is not hard chrome plating, nor makes you a hard chrome plater.

Chrome shops plating the hard way never seem to have time to learn anything new. No wonder—most of their time is spent spinning their wheels. The amount of plating jobs it takes you a week to do should be done in one or two days!

Quality-wise, on a scale of 1 to 10, 130°F shops are barely a 1 while 140°F shops using the reversible rack system are a 10.

Don't sit there gnashing your teeth—make me prove it. I can, you know. MF

HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger, Hard Chrome Plating Consultants Ltd. Cleveland, OH

XVIII—Reverse Cycles

While it's possible to plate everything without a reverse cycle, the result would be a weak bond on many materials. Such a bond may survive a sliding friction application but not be adequate for thick deposits or parts subject to shock and bending stresses. Not knowing exactly how everything you plate is going to be used requires all pieces to have the best possible bond.

All pieces that can be reversed in chromic acid should be reversed in the chrome tank. A separate chrome reverse tank is a waste of time, chrome, floor space, and equipment. That's a lot of wasted money for nothing. True, a separate reverse tank will keep the plating tank slightly cleaner, but I have never found it necessary or worth the effort.

A hard chrome plater needs to know virtually nothing about chemistry and something about electricity, but much more about machine shop practices and a lot about metallurgy. A trip to your local library to read a metallurgy book or two can only be a rewarding experience. If you don't understand the metallurgy involved in the reverse cycle, everything else may be done perfectly to no avail. That means *Rejectsville* and perhaps lost customers.

The tendency is to under reverse for two reasons. Because of the different combinations of alloying elements in various steels and different degrees of heat treating, the maximum amount of reverse for each alloy varies widely. Large spacing and slow plating rates restrict the amount of reverse you can use because you don't have the throwing power to plate even light carbon coatings.

Table 1 reverse times may be near what you use now, but in fact you may be using 1/3 as much etch as is customary in the reversible rack system of plating. For the same time, if you are plating three times faster, reverse will be three times greater. To a point this gives a more desirable bond between the base material and the chrome.

When reversing cast iron or carbon steels, you should be able to see a darkening of the surface. This will be carbon etched and drawn to the surface. However, too much carbon will weaken the bond and make the surface difficult to plate. Low-carbon steels will turn a reddish hue in reverse, while high alloy steels turn gray. If you don't know the alloy you are reversing and can check progress of the reverse cycle by looking at the surface, the above colors will tell you how much reverse to give it.

Check the surface color at the 15 second, 30 second, 1 minute, 1½, 2 and 2½ minute points if you can go that long. You don't have to look at all of these points if it's obvious that the surface isn't changing quickly. High alloy steels will turn gray between the 15 second and 1 minute points. They will show an etch quickly and it must not be overdone or the piece will not plate.

High-carbon steels will turn blackish between the 15 second and 2 minute marks depending on the percentage of carbon they contain. Low-alloy and carbon steels will stay bright and only start turning slightly red at the 3 minute mark. Red turning steels can tolerate hours of reverse and still plate. If a rack is left in reverse accidently, check the color. If it is black or gray, it will have to be repolished or ground if it's not completely scrap. If it's red, turn the rack around and plate it.

In Table 1 the first column shows AISI numbers that you will find on most complete blue prints. If the customer only sends in a small drawing or part of a larger print, the material and heat treat box may be missing. A phone call may supply the missing information.

How important this is can be clearly seen in the *seconds reverse* column. These reverse times are about 50 to 70% of the maximum reverse they will take in the average condition of heat treatment they are usually in. Metals in the annealed or soft state can usually tolerate two or three times more reverse than listed. This is another good argument for visually checking reverse progress when possible. Need I say there must be good lighting over the chrome tank?

The first of the four numbers in the standard and alloy steel columns indicate the type of steel it is. Second number is the percentage of the principal element, while the last two are the carbon content expressed in hundredth of one percent. An example is 5160, which is a chrome steel with about 1% chrome and 0.60% carbon. Table 2 shows the first number for the dif-

Table 1. Chart for Calculating Reverse Cycles in Reversible Rack Plating

Steels (AISI Nos.)	*Seconds*	*AISI No.*	*Seconds*	*AISI No.*	*Seconds*
Standards Steels				*Cold Work Air Hard*	
1005 — 1039	300	316L	120	A2 — A6	60
1040 — 1060	180	317 — 385	90	A7	30
1064 — 1095	90			A8 — A9	90
1108 — 1119	300	*Magnetic Stainless*		A10	40
1132 — 1151	180				
1211 — 1215	300	403 — 416	90	*Cold Work Oil Hard*	
1330 — 1345	120	416SE — 436	60		
1513 — 1527	300	440 A B C	45	01	90
1536 — 1572	120	442 — 446	60	02	120
		501 — 502	120	06	60
				07	60
Alloy Steels					
4012 — 4028	180	*Hi-Temp Hi-Strength Steels*			
4037 — 4047	120	601	60	*Shock Resisting*	
4118 — 4161	60	602 — 604	120	S1 — S7	70
4320 — 4340	60	610 — 616	60		
4419	180	617 — 618	45	*Mold Steels*	
4615 — 4626	120	619	90		
4718 — 4720	120	630 — 650	120	P2 — P21	120
4815 — 4820	120	651 — 652	45		
5015	120	653	60	*Special Purpose Steel*	
5120 — 5130	120	660	120		
5132 — 5160	60	661	20	L2 — L6	60 — 120
51100 — 52100	60	662 — 665	120	F1 — F2	60
6118	180	670 — 671	5		
6150	90	680 — 690 Vapor Blast**		*Water Hard Steels*	
8615 — 8630	120	50% Sulfuric Wash			
8637 — 8655	60			W1 — W5	60 — 180
8720	120	*Hi-Speed Tool Steels*			
8740	60			Cast Iron Gray	5
8822	120	M1 — M4	60	Cast Iron Chilled	30
9254 — 9260	90	M6	20	Cast Iron Malleable	40
		M7 — M10	60	Meehanite	60
Boron Steels		M30 — M43	30	Cast Steel	60
		M44	20	Semi Steel	60
50B44 — 50B60	90	M46 — M47	30	Lead	0
51B60	60	T1 — T2	60	Copper	0
81B45	90	T4 — T5	30	Zinc	0
94B17 — 94B30	120	T6	20	Brass	0 — 15
		T8 — T15	30	Bronze	0 — 15
*Sainless Steels***				*Aluminum bronze — wet with*	
		Hot Work Tool Steels		Caustic 5 min. No reverse	
201 — 304	60			Silver Solder	0
304L	120	H10 — H14	60	*Beryllium copper cut Voltage*	
306	60	H19	30	Carbide	Vapor Blast
308	90	H21 — H26	45	Stelite	10 to 30 in
309	45	H41 — H43	60	Ferro Tic*	Electric Strip
309S	90			*Carburized & Hardened —*	
310	45	*Cold Work Tool Steels*		Pack Hardened	180
310S	90			Vapor Carb	30
314	45	D2	60	Cyanided	60
316	90	D3 — D7	30	Nitrided — Vapor Blast	5
					Also pickle or reverse BP

*45 seconds in the chrome tank

**35% sulfuric 5% fluoride reverse tank can also be used. Hydrofluoric acid may be used instead of the fluoride salts.

ferent types of steels.

Although some of the steels will take more than three minutes reverse it isn't necessary to give them more than that. Low-carbon, low-alloy steels will electropolish and plate smoother at longer reverse cycles but this can prove to be more expensive than a polish job.

All stainless steels that have less than 15% nickel, which includes all 400 series and all except one or two 300 series (these may be borderline) can be reversed in the chrome tank. They have to be thoroughly degreased before plating because some tough-to-remove cutting oils and drawing lubricants are used when making these parts.

Table 2. Designations (First Numbers) for Steels

1. Carbon steels
2. Nickel "
3. " chromium steels
4. Molybdenum steels
5. Chromium "
6. " Vanadium
7. Tungsten
8. National emergency steels
9. Silico manganese steels

A final polish or glass beading will prevent peeling if you have trouble degreasing. High-nickel alloys, 16% or higher nickel, can be reversed in a 25% sulfuric, 5% hydrofluoric acid bath.

Higher concentrations of these two acids can be used, but are a waste. The lower concentration works perfectly, while higher con-

concentrations will only be rougher on the aluminum rack and stopoffs besides increasing drag-in to the chrome tank.

A word of caution—when pouring this much sulfuric acid into water, *it will get very hot!* Use protective clothing and eyewear and add the acid *very, very, very slowly.* If you don't use ice in, or cooling water on, the outside of the tank, it will take at least eight hours to add the acid.

Hydrofluoric acid should never be put in a glass container as it will dissolve glass in a short time. *People also!* The mixed solution will be 30% acid, so use with caution. High nickel alloys such as 680 to 690 Hi-temp, Hi-strength steels, Inconel, Hastelloy and more than 100 other high nickel alloys are reversed for 15 to 30 seconds, then put in plating position for another 30 seconds.

Give these parts a thorough water rinse, then immerse them in the chrome tank with the voltage at 3.5 V. Turn the voltage back up to plating voltage promptly.

Cobalt-containing alloys may only take five seconds reverse and Monel metal should not be reversed at all, only 30 seconds in plating position in the high nickel etch bath. This bath should be run at 4.5 V and its bus bars can be connected to the chrome tanks.

Starting with High Speed Tool Steels, letter numbers M1 through Water Hard W5 are letter numbers you will find stamped somewhere on all types of tools, punches and dies. Look for them before stopping off the part.

You should remember the *A* numbers are *air hard, O* numbers *oil hard* and *W* numbers are *water hardened.* The method of quenching steels gives you a clue as to the quantity and number of alloying elements present. Air hardened have the most, water hardened the least. Also notice that air hard have short reverses, oil hard in between, water hard the longest.

The list of materials are most of the ones you will be asked to plate. A few of them could use more explanation. Aluminum bronze is exactly that, with enough aluminum to cause a peeling problem.

Usually your first introduction to it will be crackle chrome all over when it comes out of the tank. If it is stripped in muriatic acid, neutralized in caustic, rinsed in water, put back in the tank without polishing or otherwise touching the surface, it will plate right.

If you know it's aluminum bronze, wet the surface with caustic for five minutes, which will eat the aluminum off the surface. It will then plate right the first time.

Carbide and stellite can't be reversed in the chrome tank, as even a few seconds reverse will bring up a loose carbon layer and remove too much material. Misses and peels will result. Reverse in the caustic strip tank will give it the proper etch.

I have plated carbide cutting surfaces that held up in use, but don't recommend it. Stellite can also be reversed in the high-nickel etch bath. Ferro Tic is an alloy of carbide with one of several steels. Some of them act like a pure carbide and the electric strip treatment works. Strangely enough, it if doesn't, 45 seconds reverse in the chrome tank will.

The customer usually doesn't know what type of Ferro Tic he has, so you may have to try both procedures before you get the right one. Cheer up, you have a 50/50 chance of being right the first time!

Carburized and hardened is a heat treatment on low-carbon steels. This allows most of the part (the core) to remain soft and tough while only the surface, that has absorbed carbon, will harden. This is accomplished in one of two ways.

One method is to *pack the parts in steel* boxes with charcoal as the carbon source. Now you know why it's called *pack hardening.* The other method is to add carbon to the furnace atmosphere, hence the name Vapor Carb. As you can see, there is a big difference in the reverse for each one. The carbon in a vapor carb piece is easily reversed back out so about 30 seconds is all it can stand. If you don't give a pack hardened piece at least three minutes reverse it will probably peel.

I don't know of any sure way you can tell which is which before you reverse it. The customer will only *tell you that it's been carburized* and hardened. It's best if you reverse these 30 seconds and look at it. A pack hardened piece will not have changed much while the vapor carb piece will have a decidedly black look. If it has been pack hardened, continue the reverse for exactly another 2½ minutes.

Cyanide hardening (sometimes called "carbo-nitriding") isn't being done very often any more, but it is another process for surface hardening. Nitrided pieces can be a problem. An alloy called "Nitroloy" is sometimes used for this process, but you may also see parts made of it that haven't been nitrided. The problem is the scale produced during the nitriding process. Too often all of the scale is not ground off and the chrome will either peel on it or the reverse will turn it black so it will not plate.

When the scale is ground but not quite removed it will look almost exactly like the base material. You need good eyesight to be able to see the slight difference in shading. The scale remaining can be quite thick and that can be another problem. If it's removed there may be many unsightly depressions. Small plastic mold core pins can almost be destroyed because so much of it is scale.

The surface that doesn't have scale on it is easily plated, so if the pieces are muriatic stripped or pickled the scale will be removed. The vapor blast or glass bead advice and only five seconds reverse hopefully will give the piece a mechanical bond on both the steel and scale without turning the scale too black to plate. This is particularly advisable on thin core pins or other thin sections. Pins thicker in diameter, ¼" on up, can be reversed 30 seconds in the chrome tank or pickled in a muriatic acid strip to loosen the scale.

This can be followed with either

glass beading or polishing depending on the finish required. Large pieces will have to be pickled. You may need to plate only a small bearing area, so before pickling, protect the rest of the part from scale removal damage. Most of these surface hardening heat treatments only penetrate the surface about 0.015" or less. If the surface has been ground undersize enough, you may be plating the softer base material.

To treat metal sprayed surfaces, use vapor blast or glass bead, no reverse. You can't strip most metal sprayed surfaces. Most are extremely porous so muriatic acid will make mush out of them and a caustic strip will load the pores with caustic, which will most likely cause it to peel. The only safe out is to have it reground if you botch it the first time.

To avoid this, wet it down while dropping it in an oil-free area of the tank. You should be aware that a metal sprayed bearing may have been turned down 0.100", plus a series of deeper grooves have been machined into it. If you lose the metal spray, the bearing might need 0.150" or more to bring it back to size.

Table 1 is based on plain round outside diameters. For other shapes and conditions subtract the percentages shown on Table 3.

Table 3. Factors for Reverse Cycles on Shapes from Table 1 Data

Subtract 15%	for	inside diameters.
10%	"	flat surfaces.
20%	"	splines, slots.
80%	"	fluted surfaces such as taps, drills.
10% or more		if the surface is in poor condition.

So far we have made a good dent in what you should know about metallurgy as it pertains to hard chrome plating. You should make copies of the tables, put them in transparent envelopes, and hang them near your chrome tanks. Next month, racking principles. MF

Problems for Weiner's article — **see page 95**

Problem 1

Write the symbols for the following elements

Aluminum	Lead
Cadmium	Magnesium
Calcium	Manganese
Carbon	Nickel
Chlorine	Nitrogen
Chromium	Oxygen
Cobalt	Phosphorus
Copper	Silver
Fluorine	Sulfur
Gold	Sodium
Hydrogen	Tin
Iron	Zinc

Problem 2

Write the elements for the following symbols

Al	F	N
Cd	Au	O
Ca	H	P
C	Fe	Ag
Cl	Pb	S
Cr	Mg	Na
Co	Mn	Sn
Cu	Ni	Zn

For Answers refer back to page 95

FINISHING POINTER

by J.B. Mohler

Agitation of a Plating Bath

The fundamentals of a plating bath include the composition, concentration, current density and agitation. Consider each chemical in the composition, the concentration of each, the range of the current density, the effects of temperature and agitation. How long will it take to say it all about one type of bath? Too long!

Set the limits or discover the limits of a specific bath and you will have an opportunity to discover all that you need to know about that particular bath. You might set nice, comfortable, controllable limits of a cyanide bath that responds to total concentration, free cyanide, metal content and temperature.

Then along comes the energy crisis and pollution control. Now you need a new set of limits for a low cyanide bath. So it pays to know about each variable and the influence that it can have. Possibly the least of these variables is agitation, but it is worthwhile to consider what it does so that it will be taken into account when a change must be made.

R.O. Hull Sr. once expressed the thought about a chromium plating bath, that it might only be limited by the size of the bus bars. He was saying that there would be essentially no limit on the current density in a chromic acid bath if the bath composition and temperature were controlled as necessary and the current density were allowed to increase in proportion to the cross sectional area of the bus bars.

He was also suggesting that usable deposits at the high current density might be possible because of the low cathode efficiency that provided effective agitation due to profuse hydrogen gas evolution at the cathode. This bit of fantasy did not consider the problem of containing the solution in the gassing tank but it did put the potential influence of a moving solution into perspective.

Real experiences with rapidly moving solutions over a cathode surface indicate that sound metal can be deposited quickly when the solution is moved at high velocities.[1] However, there is a limit to the rate at which the metal in the solution can be brought to the cathode surface. There must also be a limit to the current density, but Graham and Pinkerton showed, for example, that it was above 3000 A/ft^2 for lead deposited on a rotating cathode surface.[2]

High current densities applied to moving strip and wire, in continuous plating lines, also show that plating rates can be increased substantially when there is selective movement between the cathode and the solution. Imagination and facts tell us that solution movement has a great influence on the depositing metal. So it is interesting to contemplate the influence that agitation can have.

Should every bath be agitated? No! But agitation in every bath should be considered. What does it do? It allows high current densities, keeps the bath well mixed, reduces polarization at the electrodes and increases the plating range.

Agitation can be a nuisance as well as a boon to the plater. It can disturb the sludges on the anodes and on the bottom of the tank. It can carry sludge to the work where it will cause rough plating and it can increase the plating of noble metal impurities in the bath.

Table 1. Possible Benefits of Agitation

1. Composition: Agitation extends the plating range so that the bath may operate within wider limits.
2. Concentration: Agitation brings more metal to the cathode surface so the chemical concentration may be lowered if desired.
3. Current Density: Agitation may allow an increase in current density as an alternate to a lower bath concentration.
4. Temperature: Agitation will promote an increased response to automatic temperature control.
5. Anodes: Agitation reduces anode polarization and aids anode corrosion.
6. Cathodes: Agitation may allow operation at a higher current density.

A hot bath such as an alkaline tin bath will keep itself adequately mixed by thermal convection. A low efficiency bath such as a copper cyanide strike will keep itself mixed by electrolytic gassing. A moderately warm, relatively high efficiency, bath such as represented by bright nickel, will respond to mild agitation.

Without agitation the bath will suffer a loss in plating range due to diminishing concentration in the vicinity of the work. This is often avoided with cathode rod agitation that replenishes the depleted solution (cathode layer) by movement of the cathode.

Increasing metal concentration in

(Continued on page 8[illegible])

one form to another. How does this apply to our shop?

If we buy 100 lbs of nickel, 100 lbs of nickel must go someplace. Some of it goes on the parts as an elec plated coating. This will give us a good day. If the plater forgets the water hose in the nickel tank on Friday afternoon, the solution will go down the sewer. Nickel is neither gained nor lost to the world but it is lost to the plating shop. Also the allowable limits of the effluent will be exceeded.

So we lost money for the nickel the cost of fines for the effluent and Monday the tank will not plate. Fumes could waste nickel in a similar manner. Don't you think Sonny will learn some useful things as he studies chemistry?

Next we will discuss the Law of Conservation of Energy. This states that under ordinary conditions *energy can be neither created nor destroyed, but only changed from one form to another.* The various forms of energy are heat, mechanical, electrical, light, sound, and chemical. Great, but what does this mean to the finisher? One example will explain the significance.

If a plater in "Rejectville" on bad day—Friday—leaves a heater on in a hard chromium tank, *energy is not wasted*. The electrical energy keeps heating the solution, the tank and the surrounding air. No energy is wasted to the world, only to "Rejectville."[2]

Now walk through your metal finishing shop. Use the chemistry you have learned. The Laws of Conservation of Matter and Energy mean chemicals can be used or wasted. We can account for all the chemicals and energy. We can use more of the chemicals and the energy and waste less.

In subsequent articles we will explain chemistry and discuss how we can apply chemistry to improve the quality of your finishing, and go down the "Cause-Effect Highway" to beautiful "Profitland" and Good **Days.** MF

References

1. L. Pearce Williams, Michael Faraday, Library of Congress Card Number 65-19542, p. 22
2. Milton Weiner, Good Days — Bad Days: Energy, Metal Finishing, 79, 3, March 1981, p. 39

10. Anode Reactions

Oxidation of Trivalent Chromium

In a chromic/sulphuric acid solution, trivalent chromium is formed at the cathode during electrolysis and is oxidised to chromic acid at the anode, where oxygen is evolved. Such oxidation is a function of the nature of the anode and its surface area. The nature of the anode and its surface area in relation to cathode conditions must be such that the trivalent chromium (chromium chromate) content remains stationary at ¾-1½ oz./gal., otherwise the solution may become useless due to increasing resistance following loss of free chromic acid.

Use of an insoluble anode is essential since soluble anodes, *e.g.*, chromium metal, dissolve rapidly and do not allow oxidation of trivalent chromium. Antimonial lead (6-8% antimony) is most commonly employed and the greater the anode area, the greater the oxidising effect. That the material of construction is more important than the anode area is demonstrated by the work of Haring and Barrows[50]. Solutions containing 43 oz./gal. chromic acid and a fairly high initial concentration of chromium chromate were operated with lead and iron anodes and with anode:cathode areas of 1:3 and 3:1, at 113°F. with a cathode current density of 90 amp./sq. ft. The results are summarised in Table I from which the tremendous increase in chromic acid final concentration following the substitution of lead for iron anodes, will be obvious.

Table 1. Effect of Nature and Surface Area of the Anode on the Oxidation of Trivalent Chromium.

Anode : Cathode Area	*Anode Material*	*"Free" Chromic Acid*	
		Before Electrolysis	*After Electrolysis*
1 : 3	Lead	84	95
	Iron	84	50
3 : 1	Lead	84	98
	Iron	84	65

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Table IV. Plating Speed (In Thousandths of an Inch per Hour)

Current Density	*Sulfate Bath*			*Mixed Catalyst Bath*		
A/in²	*110°F*	*130°F*	*150°F*	*110°F*	*130°F*	*150°F*
1.0	0.43	0.31	0.30	0.48	0.43	0.38
2.0	1.06	0.80	0.75	1.24	1.20	1.1
3.0	1.75	1.40	1.24	2.1	2.0	1.9
4.0	—	2.06	1.82	—	2.9	2.8
5.0	—	2.78	2.44	—	3.8	3.7
6.0	—	3.54	3.08	—	—	4.5

phase may go out. While in other plating baths this may not produce defective work, in chromium plating solution, a dull plate would be obtained immediately along with a reduction in thickness. As discussed previously, the mixed catalyst baths are less sensitive to AC ripple problems than the conventional sulfate bath.

ANODES

In chromium plating, an insoluble anode is used since chromium is replenished by the addition of chromic acid. Iron anodes have been used but are not generally suitable because they add iron to the bath and allow the build-up of trivalent chromium. Platinum has had limited success but also allows the build-up of trivalent chromium in solution. The universally used material is lead or lead alloy, especially 7% tin, which oxidizes the trivalent back to hexavalent chromium during electrolysis.

The reaction at the anode is dominated by the formation and release of oxygen, but a side reaction is the oxidation of trivalent chromium when it is present. During use, lead dioxide forms on the surface of the lead and the anodes occasionally may be cleaned by electrolyzing outside the plating tank, by soaking in special cleaning solutions, or by scrubbing. Often the anodes can be activated by electrolysis before each use. The important thing to watch is that the resistance on the anodes does not rise as they age due to scale buildup.

The ability of the lead anode to keep the trivalent chromium at about 0.5 oz/gal or less is dependent on keeping the lead anode active and the ratio of anode to cathode area above 1:1 and preferably above 1.5:1. As the ratio is lowered to less than 1:1, the tendency for trivalent chromium to accumulate in the bath increases sharply. If the amount rises above about 1 oz/gal problems become significant. Above 2 oz/gal, the problems get progressively worse until the bath becomes unsatisfactory for use. These problems include burning or rough chromium deposits at high current densities, possibly a brown film at low densities, and definitely a tremendous decrease in bath conductivity so that only low currents are obtained at full tank voltages. 2 to 1 is best

If the type of plating requires that the lead anode area be less than the cathode area, then auxiliary electrolysis may be required. This may be done in the same tank if time (e.g., overnight) or space are available, or it may be done in a separate tank. The anode area may be 20 to 30 times the cathode area (e.g., a small cathode with regular tank anodes) to increase the rate of oxidation. Raising the temperature to 130 to 150°F and solution agitation are also beneficial.

Care and control of anodes rank with control of solution chemistry and operating conditions for successful chromium plating.

FIXTURING AND RACK DESIGN

For both decorative and engineering chromium plating, careful attention is required for fixturing and rack design. The techniques for decorative plating, with its very thin deposit, are very different than those for engineering plating, with its much thicker deposit. In engineering chromium (hard chrome), a major objective is to obtain very

21. ANODES

Anode Materials

Pure lead anodes may be used but it has been found that they are attacked by the solution and form excessive amounts of lead chromate. The most common anode material is a lead alloy containing 6-8% antimony which is mechanically stronger and more resistant chemically. Alloys containing about 7% of tin are also in commercial use and are preferred in solutions containing fluorides. Lead anodes with small percentages of silver or tellurium have been the subject of experiment but have not been adopted in practice.

Which ever material is employed, purity is of the greatest importance. In the case of un-alloyed lead, the electrolytic material, 99.99% pure, is generally employed. Antimony must also be pure and free from arsenic[353] which may cause rough deposits even when only traces are present.

There is a tendency for lead anodes to warp and bend during use and since this must be avoided at all costs in hard chrome deposition, which relies on accurate anode-cathode positioning, it is customary to employ anodes which are either corrugated or else are provided with thick beaded edges to provide added stiffness. There does not appear to be any justification for the claim which is sometimes made to the effect that corrugated anodes improve throwing power. Where a more rigid type of anode is required, steel covered with antimonial lead may be used and for higher conductivity, copper similarly covered.

Although oxidation of trivalent chromium does not take place on a platinum surface, this metal can be used for deposition in small holes.

Chromium anodes are not satisfactory as they dissolve anodically to the trivalent state and there is no possibility of oxidation to the hexavalent state. Some shops hang an anode on a cathode rod when plating small areas. This is a practice which is not to be recommended because, if the anode becomes coated with metallic chromium

and is then replaced on the anode rod, it leads to the production and accumulation of trivalent chromium in the solution. A scrap cathode can be used instead. Steel, nickel and aluminium do not give good results for similar reasons. However, pure iron, electrolytic iron or armco iron may be used. Such anodes corrode less than steel but they are not satisfactory for continuous use as they give rise to a high concentration of trivalent chromium and iron in the solution. Anodes for use on internal surfaces or to conform to complicated shapes may be constructed from soft iron wire and electro-deposited with lead before use.

Anode Area

The anode:cathode area has been variously recommended as 2:1, 1:1, and 1:2. Which is the best to use depends on the conditions under which one is operating. All these recommendations can normally be complied with in the case of deposition on exterior surfaces which permits some flexibility in the anode arrangement. In the case of internal deposition, it is often impossible to do so as the shape and size of the anode are conditioned by the surface to be plated. If the anode area is too small, the regeneration of chromic acid will be insufficient and the trivalent chromium content may rise to dangerous proportions.

A practical method for overcoming such difficulties is to arrange for alternate internal and external deposition. In addition, the anode area can be increased during deposition on external surfaces. Alternatively, the solution can be regenerated by working with a large anode area whilst isolating the cathode by means of a porous cell which prevents trivalent chromium from migrating to the main solution (see page 469).

Where there is sufficient room, build-up of trivalent chromium and anode polarisation can often be avoided by cutting corrugations in the surface of the internal anode or by burning strips of lead on to its surface to increase the anode surface area. Thus, in plating cylinder liners, it is usual practice to cut a fairly coarse thread on the face of the anode. Care must be taken to ensure that the depth of thread or thickness of such additions is not too great. Otherwise, in view of the short anode : cathode distance, rarely exceeding $\frac{1}{8}$ in., such variations may be reproduced in the thickness of the deposit.

Anode Maintenance

During deposition, antimonial lead anodes become covered with a layer of black lead peroxide (PbO_2) which protects the surface from attack and assists oxidation of trivalent chromium. When new anodes are first put into use, it is best to pass current immediately until the protective layer of lead peroxide has been formed. Whilst antimonial lead anodes are insoluble in chromic acid, they may become covered with a layer of yellow lead chromate ($PbCrO_4$) if left in the solution when current is not being passed. This layer is an insulator and may upset the current distribution. It should be removed either by brushing or by dissolving in a solution of sodium chloride acidified by the addition of a small quantity of hydrochloric acid (Salauze[illegible]) or by electrolytic cleaning in a 10% caustic soda solution at 160-175°F. with a current density of 100-300 amp./sq. ft. (Bilfinger[illegible]).

The lead chromate coating may also be converted readily to peroxide by working the anode hard, that is, at a high current density for half an hour or so using scrap cathodes.

It follows that it is good practice to take the anodes out of the solution when the vat is not being used. They should be swilled, brushed with a fibre or bristle brush, swilled again and allowed to dry. They can then be put into use again immediately plating is to be resumed since this treatment does not impair the peroxide coating. The change from brown or black to yellow is also a good indication of which anodes are working (making good contact) and which are not.

ıcid which may be dragged in from nickel baths, and the list of other 'complexing agents" is legion. A method of determining the relative strength ıf complex fluoride catalysts by means of the rate of solution of aluminum ıas been patented [87].

An unexpected behavior of solutions catalyzed largely with fluoride or silicofluoride is that the current efficiency increases with increasing chromic acid concentration in the usual commercial range, whereas in sulfate-catalyzed baths the reverse is true. This behavior is portrayed in Figure 8.

NOTES ON OPERATION

ANODES

Lead anodes, insoluble in chromic acid solution, are almost always used in chromium plating from chromic acid baths. The film of lead dioxide which forms on these anodes during use causes the chromium(III) to be reoxidized continuously to chromic acid, thereby keeping its concentration at a low value.

Anodes of chemical lead can be used; but, as compared with lead alloy anodes, they are much more readily attacked by the solution and cause the formation of excessive amounts of lead chromate sludge. Antimonial lead is preferable to chemical lead because of its greater corrosion resistance and strength [88]. Lead-tin alloys have high corrosion resistance and are widely used [89].

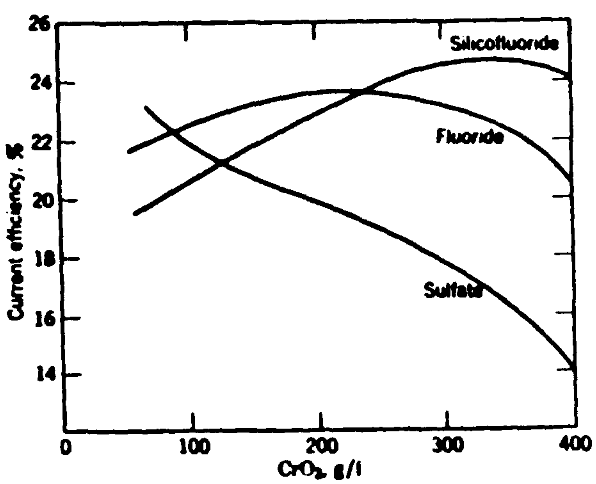

Fig. 8 Current efficiency versus CrO_3 concentration. (Bilfinger [60])

Some workers also recommend lead-silver alloys [90–93], but they are expensive. However, various combinations of silver with tin, antimony, or both are useful, and are available commercially.

Lead and lead-alloy anodes of varying cross section have been proposed *from time to time. It is important to use thick enough anodes to conduct the* high currents required. Anodes that are too thin will overheat in use and tend to corrode and warp excessively. Cibulskis and co-workers [94] avoided this difficulty by the use of solid round lead anodes. These aid in securing good current distribution because considerable current can come from the *back as well as the front.*

Many anode materials other than lead alloys have been tried, but nothing better has been found [5]. Pure iron, such as Armco or electrolytic iron, is corroded less as anode than steel, nickel, stainless steel, or similar alloys. Iron anodes have occasionally been used, particularly in industrial chromium plating, in special instances where greater strength and rigidity than are obtainable with lead are desired. Their continued use, however, leads to the accumulation of iron and chromium(III) in the bath. Where iron anodes are used, it is recommended that they be coated with lead whenever feasible. Small platinum wire anodes can also be used for special purposes, such as plating the inside of very small openings, like those of wire-drawing dies.

Auxiliary conforming anodes are sometimes used through the complete cycles of decorative plating to get improved coverage on difficult shapes, or more uniform plate distribution on significant surfaces where a minimum plate thickness is required, as for the production of microcracked chromium. Pure nickel anodes are perhaps the best for this service, and cast nickel is sometimes used to produce a number of anodes of a special shape. Platinized titanium anodes are also used for this service, but have the disadvantage of a limited life and insufficient indication of when they are becoming inoperative, except for increasing rejects. Nickel dissolves slowly in use and can be replaced when visibly worn away.

Lead anodes used in chromium plating cannot have too heavy or irregular a coating of lead dioxide on them, or the current distribution may be affected. It is customary to clean anodes regularly, especially those used in heavy hard chromium plating which conform closely to the article being plated. The cleaning is done by means of acid dips and scratch brushing but is difficult and time-consuming, and frequently not all the semiinsulating coating is removed. Hyner [95] developed the method of electrolytic reduction of the coating to metallic lead by cathodic treatment in an alkaline pyrophosphate solution. Alkaline immersion dips are also used [96, 97], but they are not as powerful in their action.

Lead anodes coated with lead dioxide tend to become "passive" after

HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger

VI—Lead for Hard Chrome Plating

At one time all of the conforming anodes used for hard chromiun plating were made of 6% antimony lead. Because of the advantages and general superiority of cast lead we now only make small anodes, that can't be made from cast mats, out of rolled sheet lead. With ½ inch anode to cathode spacings, the lead has to be stiff. Tin-lead is too soft and shouldn't be used. Antimony is a relatively hard and brittle metal and a small percentage has a strong hardening effect on lead. In the form that you can buy it, you only need hit it with a hammer to make smaller pieces.

New 6% antimony *rolled* lead will plate at a certain rate for about 60 hours. Then, rather suddenly, it will drop down to about a 10% slower rate. There seems to be something about the rolled skin that allows it to plate faster. Scraping the anode down to clean lead will not bring back this faster rate. I have not seen this happen when using *cast* lead anodes.

Rolled or extruded lead will develop large hard flakes in a plating solution. These can cause rejects if they fall on a shoulder and stop off part of the surface being plated. It is easy to keep small anodes brushed clean. They should be brushed after the last use while still wet. Cast lead doesn't form flakes because the oxide remains in small grains. This is one reason this type of lead plates so well. The fine texture of the oxide layer also allows it to reform quickly to plating condition after it has been dormant in the tank for a while.

Cast lead mats are made out of scrap lead (see Figure 1). If all your scrap is 6% antimony, it should be mixed with some junkyard lead scrap. ...t 6% antimony lead age hardens ... quickly and tends to become too ...ttle. Addition of about 60% junkyard scrap makes it more suitable for anodes. A barrel of junkyard lead usually contains many alloying elements

(Photograph by the author, courtesy Simmons Plating & Metal Finishing, New Orleans, LA.)
Figure 1. Bright chrome tank anodes made of scrap lead mats.

with the lead.

What the final alloy of any particular mat is doesn't seem to make any difference as regards to its plating characteristics. There will be some variation as to how fast it age hardens. Conceded, in a lab you can prove some alloys plate faster than others. We won't nitpick this point because we don't plate in a lab but in a job shop. What I am telling you here gets the job done at the lowest possible cost under job shop conditions.

LEAD FOR HARD CHROME PLATING

If the mats are to be bent or formed, this should be done as soon as they cool after casting. In a few hours it may be impossible to bend them without breaking them. Always bend them around a pipe or form them on the piece to be plated, using a wooden paddle. The lead mats can be made ahead of time and at a later time be put in an oven at 375°F for a couple of hours. This will anneal the alloy and make the anodes bendable again for an hour or so. Small anodes with small radiuses (or radii) should be made from thin mats. Just cover the bottom of the mold when pouring. Large anodes should be made with full mold thick mats.

The design of the lead mat mold is important. If the holes are too big it will show up as a waffle pattern in the plated piece. If the holes are too small, you lose throwing power. If the lead ribs are too small, the mats will not be able to carry the current for large anodes. If the mold is made too big it may be impossible to unmold the mat. Making the best possible mold is not simply like running a milling machine over a piece of metal.

My visits to plating shops have

shown me far too many of you are trying to make anodes using soldering irons, plumber's acetylene air torches, and are using flux. These are extremely bad tools for "burning" anodes together. Even if the anode holds together long enough to plate the job, it will fall apart sooner than later.

To make good, long lasting anodes, use a light weight torch with 0 and 00 tips, fueled by either acetylene, butane, or natural gas with *oxygen*. Professional lead burners use *hydrogen* gas, but for you this isn't necessary. Natural gas is the easiest and cheapest fuel to use. Do not use flux of any type. Just be sure the edges to be joined are scraped clean. If the fit between pieces isn't good, use a strip of the lead you are using for the anodes to fill in the crack.

In most cases this shouldn't be necessary. Use a small blue flame. Too much oxygen will give the flame a harsh white look; too little, a yellow look. It is better to start with a flame that is too small than to melt too much lead. Do not move the torch around and heat a wide area. The flame's inner cone should just touch the seam and move along it as the lead melts together. *You positively, absolutely, must wear eye protection!* Even skilled lead burners can have the lead spatter under certain conditions. BE SAFE, NOT SORRY!

Properly made scrap lead mat anodes will plate faster than rolled or extruded lead of any kind. They will hold their shape even when used to make huge anodes. There are a few anodes you can't make from lead mats — for these you can use 5 or 6 lb lead. The strip that goes from the working anode to the rack anode clamping bar is made of 12 lb. rolled 6% antimony lead. This is easily bent so the anode can be positioned correctly. You will also need 1/16, 1/8, 3/32, ¼, and ½ inch 6% antimony lead wire to make ID anodes. Scrap lead is selling for about 40¢ a lb, while new lead is $1.50 a lb. A better anode costs less.

Here goes another dragon: Never, never dummy run new anodes! A new lead anode will do its best plating when it is *new*, before it gets an oxide coating! How do I know? I have made and used thousands of new conforming and tank anodes of all sizes. The first few pieces plated just as good if not better than pieces plated after the oxide film formed. If your experience has been different, you should have blamed your cleaning or etch cycle. Next month I will discuss chrome plating solutions. MF

TABLE 12. CHROMIUM (BATHS)[a]

Composition	1 g/L	1 oz/gal	2 g/L	2 oz/gal	3[d] g/L	3[d] oz/gal	4 g/L	4 oz/gal
Chromic acid, CrO_3	248	33.0	398	53.0	338	45.0	180-225	24-30
Sulfuric acid, H_2SO_4	2.5	0.33	4.0	0.53	2.2	0.29	0.9-1.1	0.12-0.15
Ratio[b] CrO_3/H_2SO_4	100:1		100:1		155:1		200:1	
Catalyst	—	—	—	—	—	—	0.5-1	0.07-0.13
Conditions[c]								
Temperature, C (F)	43-49	(110-120)	43-49	(110-120)	55	(130)	38-49	(100-120)
Current density, A/dm^2 (asi)	10-22	(0.7-1.5)	10-22	(0.7-1.5)	15-36	(1.0-2.5)	15-36	(1.0-2.5)
Cathode efficiency (approximate)	13-18		13-18		13-18		16-24	
Volts	6-12		6-12		6-12		4-12	

Agitation is not generally used. Filtration is uncommon. Anodes are usually lead or a lead alloy used in the ratio of 1:1 to 2:1. Catalysts are usually fluoride compounds of one type or another. Self regulating baths use a fluoride with limited solubility present in excess so baths must be stirred occasionally to ensure solution of the required catalyst. Silicofluoride catalysts give the highest efficiency. Trivalent chromium is usually required for proper operation of the bath and is usually maintained at about 1% of the chromic acid concentration.

Suitable materials of construction: 1, 5, 9, 10, 14, 15. (Also see Ref. 2.)

Use: Bright decorative deposits 0.01-0.03 mil in thickness. Hard deposits for wear resistance 0.1 mil and heavier.

Applications: Decorative coating over copper and/or nickel protective coatings on all basis metals. Industrial or hard coatings over ferrous basis metals for tools, dies and gauges. Also for surface protection of electrotypes, engraving plates and other items. Porous coating for improved lubrication, wear and corrosion resistance of piston rings and cylinder liners.

References: 1, 2, 22, 23, 24, 28, 56; 25, 26, 27, 28

Problems with chromium plating generally revolve around proper brightness and covering power for decorative baths. These problems can usually be ascribed to one of three classes of causes:

Improper operating conditions: This includes deviations in current density, temperature, bath composition, particularly bath ratio, trivalent chromium levels or contamination with iron, copper or nickel. At the present time there is no generally simple way of removing metallic contamination. Specially constructed ion exchange units using carefully selected resins may be used in some cases, but it is far better to avoid contamination.

Improper current control: This includes inadequate or excessive current densities, excess ripple in the current supply, interruption of the current during plating, and stray currents.

Improper preparation of substrate: This includes inadequate activation of nickel or nickel iron, inadequate cleaning, etc. Nickel plated parts from solutions with excessive brightener levels can cause "rainbow" in the low current areas; stripped parts improperly activated before rechroming will not cover properly, etc.

Because of the high current densities involved, and the generally poor throwing power of the chromium solutions, racking of parts is particularly important. Racks must be of adequate cross-section, and use of auxiliary anodes, or thieves and/or shields may be necessary for complete coverage. Proper maintenance of racks is also important for the same reasons. Additionally, chromium is a serious contaminant for most plating solutions, and improperly maintained racks can carry solution from tank to tank, causing severe problems.

[a]Proprietary baths are also available (see Ref. 2, Chapter 6).
[b]Bath ratios of 80:1 to 120:1 are not uncommon (see Ref. 2 for discussion of F^- and SiF_6^- catalysts).
[c]Temperatures from 70 to over 150 F with variations in cathode current densities from 1.5-8.0 asi and cathode efficiencies between 10 and 20% are possible. For bright deposits the exact values must be carefully controlled and related (see References for detailed information).
[d]Non-proprietary crack-free process.

is eliminated. Stainless steel is usually preferred as an insoluble anode, but hard carbon, "Nichrome," and "Duriron" have also been used.

Iron. Anodes for iron plating are high-purity forms such as low-carbon "Armco" ingot iron, wrought iron, or Swedish iron, usually in the form of chill-cast or rolled slabs. The iron dissolves chemically in these highly acid baths. Bags of "Vinyon," "Dynel," or blue African asbestos are a necessity to prevent roughness.

Lead. "Chemical Grade" lead is used for soluble anodes in lead plating. The ASTM (B29-49) specification for this material is:

Pb, min.—99.90%	
Ag—0.002-0.020%	Zn, max.—0.001%
Cu—0.040-0.080%	Fe, max.—0.002%
As + Sb + Sn, max.—0.002%	Bi, max—0.005%

Sheet lead may be used as anode: cast forms are also available with rectangular, multi-edged, or corrugated cross sections and with positive-contact hooks cast integrally with the anode or soldered into a hole in the top. Sheet lead is best supported by bolting between two bus bars.

Insoluble lead anodes are universally used in chromium plating and also find other applications in acid copper and sulfate nickel plating and as electrodes in electropickling, electropolishing, and anodizing.

In chromium plating pure lead anodes are attacked by the bath when the current is off; therefore the more resistant alloys with about 6 per cent antimony or tin are used. A small loss due to chromate formation cannot be avoided, and the anodes do not last indefinitely. The rate of chromate formation is lessened, and the desirable reoxidation of trivalent to hexavalent chromium in the bath is favored if the anode has a film of brown lead peroxide on its surface. This may be formed by anodic treatment in a sulfuric acid electrolyte overnight or for several days. It will be converted to chromate when the chromium bath is idle but will reform, with some loss, when the bath is again used. The reoxidation of trivalent to hexavalent chromium is also favored by a large anode area, and many special anode cross sections, some of them patented, are available. These may be ridged, ribbed, corrugated, or multi-edged. One study[25] has indicated that round cross sections are preferable to flat or oval shapes in that the entire anode surface is active. It was also shown that there was little difference in performance between rod and tubular anodes of the same outside diameter; the latter represented a saving in weight of 25 to 40% for the 1½ to 2 in. sizes. Anodes made by casting lead around a steel or copper core are also available. These have added strength, rigidity, and conductivity and are necessary when very long anodes are used and in other special applications. Lead-plated copper rods serving as anodes in the chromium plating of gun barrels has been described[23]. Flame-surfacing the lead anode prior to use allegedly improves its resistance to attack by the chromium bath[5]. A case alloy lead anode, containing 1 per cent each of tin and silver, is reported to perform best in a continuous strip plating line for chromium (see Chapter 27).

Although lead peroxide has a conductivity approaching that of metals, too heavy or irregular a coating may interfere with proper current distribution, especially when closely conforming anodes are used as in hard chromium plating. It is therefore customary to clean the anodes regularly, which is usually done by means of acid dips and scratch-brushing. A less tedious method has been patented[20] involving cathodic treatment in an alkaline pyrophosphate solution said to reduce the peroxide to lead.

Lead anodes are frequently called upon to carry heavy currents, and they must be thick enough to do so without overheating, which warps them and causes them to corrode excessively.

Nickel. Typical analyses of the various forms of nickel anodes available are shown in Table 2. The anode polarization of nickel increases and the evenness of corrosion in a given solution decreases with increasing purity of the anode and with the amount of mechanical work, i.e., rolling or forging performed on it. However, oxide additions, as in the depolarized anodes, increase the activity markedly. Rolled depolarized high-purity anodes corrode evenly and well in all modern nickel solutions.

Cast-carbon and rolled-carbon anodes do not corrode satisfactorily in solutions above pH 4.6[6]. The carbon and silica contents of these anodes form a film on the anode surface which retains loose nickel particles long enough to permit them to dissolve[7]; otherwise an intolerable amount of sludge containing much valuable undissolved nickel would be formed. This was the principal objection to the low-carbon, low-

odes produce
and consequently are
lytic sheet anodes are

sed in acid baths to
of roughness, but they
cessful owing perhaps
iprous ion formation
ide baths, anode bags
f the anode to polarize
urrent densities; there-

niting anode current
160 asf in air-agitated
al purposes it may be
ths copper anodes usu-
ly only up to about 20

nay be used in cyanide
polarization[2], but some
d into the bath[3], which
efficiency and causes
t about 1.5 to 2 g/l of

r anodes are hung from
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me. d to lessen scrap

urity rolled-gold anodes
e cyanide or acid baths.
id solution gold anodes
rent density is too high
loride ion is present.
m cyanide bath a gold
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s. When present in the
s, lead, silver, bismuth,
ler, induce passivity as
n the solution, notably
n reported[24] that a gold
a protecting layer of
anide when electrolyzed
ons and that even traces
cyanide baths cause the
however this restriction
e sodium cyanide baths
ully operated with gold
avior of gold anodes is
ous, many cyanide solu-
l installations, are oper-
odes[4]. The bath invest-
d the possibility of theft

HARD FACTS ABOUT HARD CHROME

by Clarence H. Peger

III—Anode Spacing and Design

It's a simple fact that the closer the anode is to the surface to be plated, the more control you will have over where the plating goes. It's also true that you can plate faster and at lower voltages when you use closer spacing. The first shop I worked in used ⅜" between the anode and cathode as their standard spacing. Tank voltage was 4.2 V and solution temperature, 140°F.

This, without a doubt, is the very best way to hard chrome plate. The only drawback to this close a spacing is that you need workers with good eyesight who will see to it that the piece is centered with respect to the anode. With this spacing you can "hold to size" plate a larger variety of work. Using ⅜" spacing we plated pistons that were tapered 0.0005" because of grinder error. After 0.003" plate they were in tolerance, +0.000 −0.001, without any taper at all.

Using ½" spacing and 4.4 V, you can plate just as fast, but lose some control over where the plating goes. Unless you do a lot of "hold to size" production work, the ½" spacing, 4.4 V system works out fine. You will be trading off some plating thickness control for easier setups and larger pieces that can be run with conforming anodes.

Another example of plating thickness control is a production job that needed 0.0008" thick chromium. When using tank anodes the plating on a piece varied from 0.0002" to 0.0015" with running time of 75 min. Plated in a reversible rack with ½" spacing, 0.0008" plate with variation of 0.00003 total was produced. That's right, there are four zeros in front of that three. Hey! It gets worse, running time 23 minutes!

In this series of articles we are discussing the best possible way to plate smaller pieces such as tools, dies, molds, machine parts, etc. and OD's and ID's to about 16" diameter. It is difficult to draw a line to limit the size because many of the parts plated this way are much larger than 16" diameter. As anodes are made larger it becomes more difficult to maintain ½" spacing. The larger pieces are mostly OD's, ID's, and large flats. These are plated with 1-3" spacing at 5.5 or 6 V. More about this type of plating in future articles.

My experience is that the volume of reversible rack type of work should be about 85% of the jobs taken in by a job shop. A few jobs will be done with tank anodes, but this is a sloppy way to hard chrome plate.

Now we come to the exceptions to the ½" spacing rule. ID's as small as ¼" can be plated using 1/16" dia lead wire at 4.4 V. This is only a 3/32" spacing, but the anode to cathode ratio is 1:4, which limits the plating rate to 0.006" an hour on the diameter. This is about the smallest practical hole size that can be plated at 4.4 V, together with the other work. Methods of reducing the tank voltage to accommodate one or two racks, and anodes used to plate holes and slots as small as 0.040" dia are the subject of another article.

The smallest OD anode should be 2½" dia. An anode this size will plate a ¼" dia. rod 0.006" per hour on the OD. Here again you have more than ½" spacing, but the anode to cathode ratio is 10:1. What saves the poor little ¼" dia rod from burning up is the increased spacing. If you plate very fine wires, it's better to use lead wire anodes to reduce the amount of anode surface. You could go to a 6" anode, but the wire wouldn't plate as evenly. The 2½" anode will plate OD's from ¼ to 1" dia at the same 0.006"/hr rate. At these sizes the change in spacing balances out the anode to cathode ratio change.

When plating into corners, dovetails, shoulders, radii, or undercut areas, you can reduce the spacing to ¼". Many of you plate shouldered shafts with tank anodes and large spacings. The surface at the shoulder gets little or almost no chrome, the other end gets too much. The running time has to be excessive to make up for the uneven plating.

The same shaft in a conforming anode can be made to plate straight by turning in the anode at the shoulder to ¼" spacing with the rest having a ½" spacing. If the shaft is not being held to size it will only require a minimum of grind stock. The high plating rates and minimum grind stock make for very short tank times.

I want to slay another dragon here. Chrome is chrome and if it is deposited in the bright range the hardness is the same whether it goes on at the rate of 0.001 or 0.003" thick per hour. They didn't believe me at an aircraft factory that I worked in. We plated six samples at each rate and sent them to the lab. After a few days I had to ask, "What happened to the samples?" The reply came back, "The lab couldn't tell which was which."

When designing a conforming anode, take into consideration the cathode surface and determine what areas will plate faster or slower. By adjusting the amount of lead area spacing, problem areas can be made to plate as fast as the rest. To increase the anode area "saw tooth" the edge with a band saw. Without close spacing conforming anodes it's almost impossible to hold pieces to size with a commercial plate, i.e., plating in the range 0.003 +0.000 −0.001".

Two bus bar system reversible rack shops plate a high percentage of their work to size. This is another reason for the high volume of work they are capable of doing, using less equipment. On average, you can run four racks of commercial plate in the time it takes to plate one rack plus grind.

Next month our subject is titled "Stop Off the Better Way."

22. Arrangement and Suspension of Work and Anodes

There are no hard and fast rules governing the arrangement of the various devices to ensure even current distribution. In fact, the art of chromium deposition lies in the careful arrangement of anodes and screens and the positioning of the parts in respect of the complexity of the surface to be plated. For every problem, there are often several solutions. Some basic principles are summarised below.

Anode Arrangement

The arrangement of anodes for chromium deposition follows the same general rules as for other plating processes. However, in view of the high currents used and the necessity for obtaining an even deposit despite the poor throwing power, particular care must be taken in arranging the anodes in relation to the surface to be plated. Where conditions allow, the most usual anode to cathode distance is 5 to 6 inches. As far as possible anodes should be slightly shorter than the articles being plated to avoid excessive build up on the lower edges.

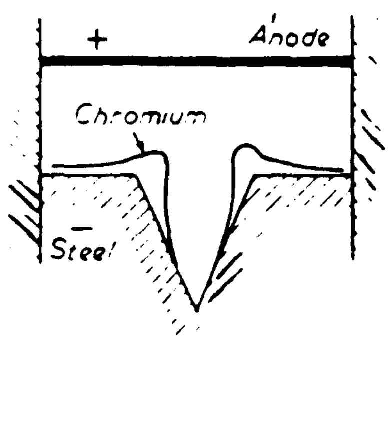

Fig. 23. Demonstrating Irregular Deposition of Chromium. There is excess deposit on the edges and lack of deposit in deep recesses.

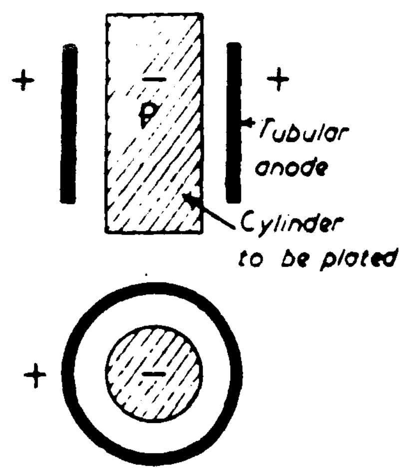

Fig. 24. Uniform deposition on the curved surface of a cylinder obtained by using a tubular anode shorter than the cathode.

The shape and position of the anodes must be considered to prevent excessive thickness on high points, and lack of deposit in recessed areas (See Fig. 23).

Take, for example, a simple case, that of plating the curved surface of a solid right cylinder. There are various possible solutions.

A tubular anode of the same length as the cylinder is equi-distant from all points to be plated. However, plating is not uniform, being thickest at the ends, particularly at the top and bottom edges due to the tendency for current to concentrate in these areas. These end effects can be minimised by shortening the anode (Fig. 24) and eliminated by using a longer anode in conjunction with false end pieces to artificially lengthen the cathode (Fig. 25).

A third solution is to use a double conical anode, the anode-cathode distances increasing progressively toward the ends of the cylinder and thus reducing the end effects (Fig. 26).

As a second example, consider the case of deposition on the interior and exterior of a rectangular box. The outside can be plated by using four anodes, similar in shape but smaller in size than the four faces of the box. For the inside a special 'X' section can be used with the edges towards the corners of the box, thus assisting a uniform current distribution (Fig. 27).

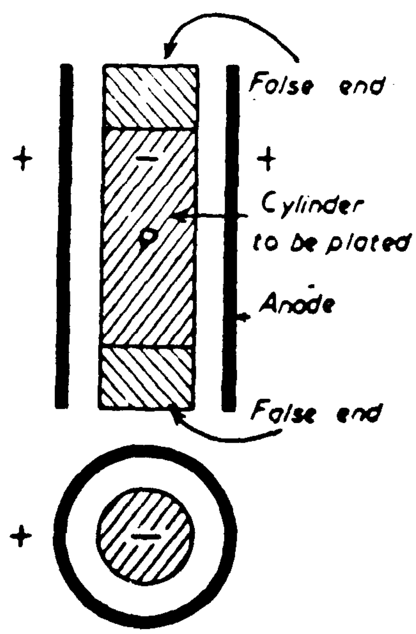

Fig. 25 Uniform deposition on the curved surface of a cylinder obtained by using false end pieces in conjunction with a tubular anode.

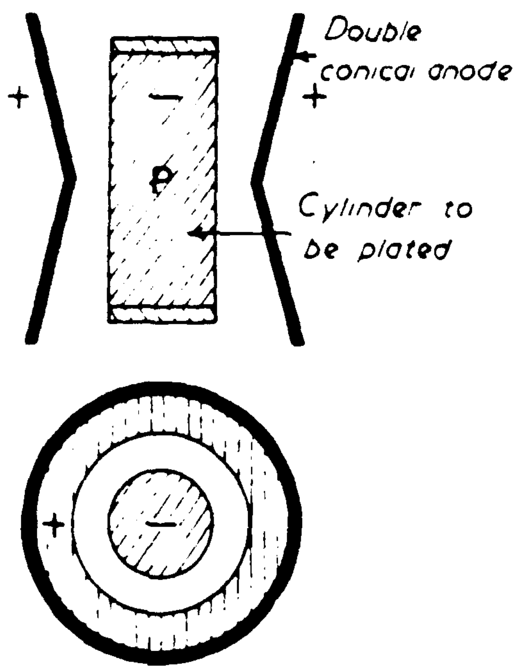

Fig. 26. Uniform deposition on the curved surface of a cylinder obtained by using a double-conical anode.

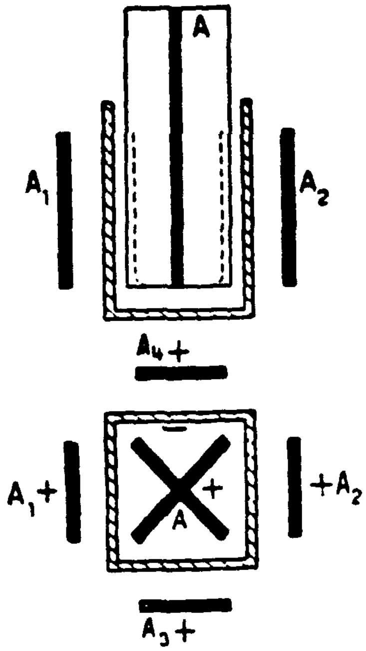

Fig. 27. Uniform deposition on the inside and outside of a rectangular box using the internal and external anodes A, A_1, A_2, A_3 and A_4.

Fig. 28 shows the anode and cathode arrangement for the plating of a cylinder liner. The cylinder itself is supported by the perforated

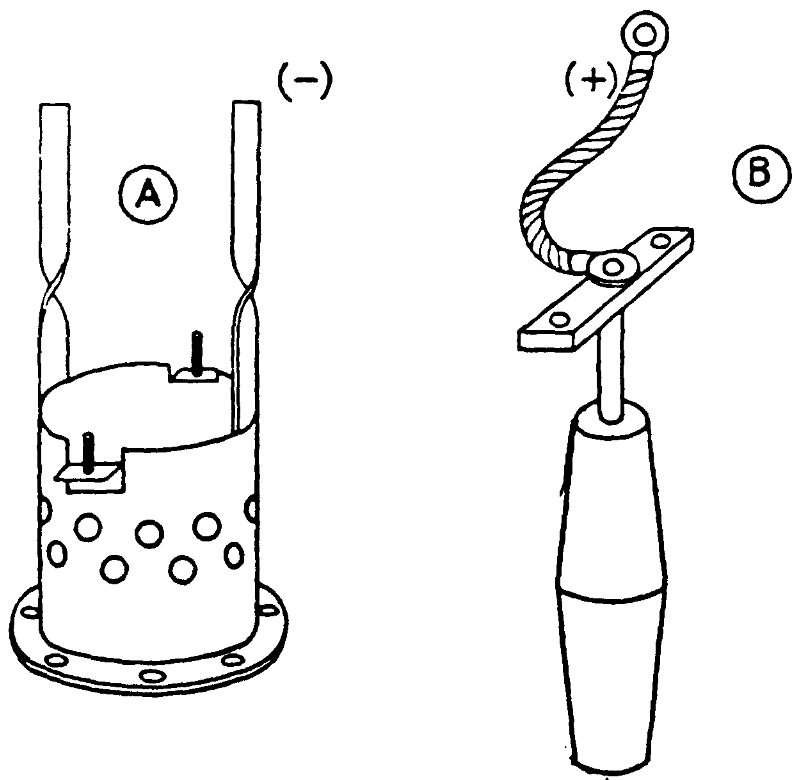

Fig. 28. Anode and cathode arrangements for plating the inside of a cylinder liner.
A : perforated ring to support the cylinder. B : double conical anode.

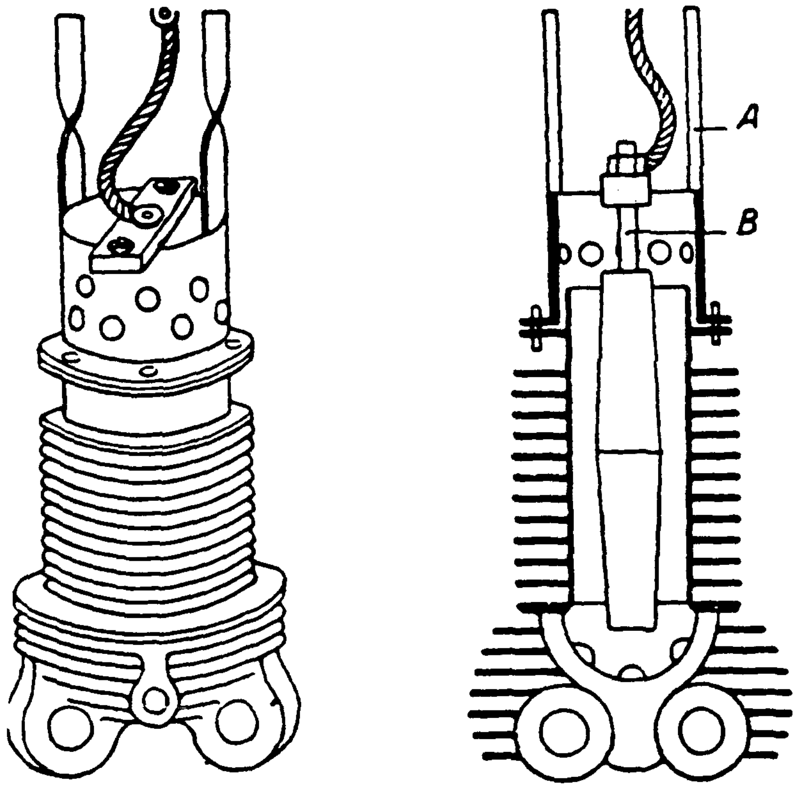

Fig. 29. Perspective and sectional views of complete arrangement for plating the inside of a cylinder liner.

ring assembly A and the anode B is double conical in shape. Fig. 29 shows the complete fixture in perspective and in section (De Vaulchier[297]).

Before deposition onto complicated shapes, the anode arrangements must be studied carefully in accordance with the principles given above. This is especially true when plating to size or when the part is to be used straight from the solution without machining. With the appropriate arrangement of anodes, it is possible to cover quite complicated shapes and the good results obtained justify the time spent in preliminary study. Some examples of specially designed anode arrangements are shown in Figs. 30 and 31.

Deposition on the interior of tubes requires an internal anode. Various arrangements are in use, one of the simplest being as follows. One end of the tube is sealed with a cork, the tube filled with chromium plating solution, and a thin steel wire anode inserted and connected to the anode rod. This method is only suitable for very thin deposits and it is more usual, especially in the case of heavier deposits, to plate tubes in the plating vat. with the aid of internal

FINISHING POINTER

by J.B. Mohler

Where Does the Current Go?

No matter how busy you are or how urgent the job; plan before you act. Spend enough time in the beginning to do it right. It's true that there is a great satisfaction in turning out work early and getting the job done, but the planning that must be done before the job starts is essential to success.

This is particularly true when the current density and metal distribution are in question. This occurs because each shape that is to be racked and plated presents a problem with current distribution that should be considered before the work starts.

If the part is to be processed through an alkaline tin bath or a low efficiency copper cyanide bath there is less need for concern, because these baths are endowed with excellent throwing power. However, if the job calls for plating with acid tin, or other high efficiency acid baths, we should ask ourselves, "Where does the current go?"

The current flows through the medium and path of least resistance. When the anodes are larger than the work the current will flow into the body of the solution and to the ends of the work where it will deposit excessive metal. To compensate for this tendency, use anodes that are a little shorter than the length of the work, as shown in Figure 1.

The special problem for a particular part may be of little importance but it should always be considered as an economic opportunity, to save time and metal. This is the time to evaluate the shape and plan for the racking of the parts and the placement of the anodes.

Parts with deep recesses require special attention. That is not to infer that plain shapes are necessarily easy. The extent of the problem depends on the characteristics of the plating bath, the required thickness, and the acceptable variation in the thickness.

Consider plating a sphere with a total variation of thickness of ±10%. It might be done with remote anodes or with closer anodes placed in all directions.

Consider precision plating on a flat sheet. It can be done by plating a sheet that is larger than necessary, with symmetrical sheet anodes, and then trimming the edges; or it can be plated uniformly within confining nonconducting walls.

Sharp corners present special problems. External corners can be robbed but internal corners will not accept a deposit completely into the corner. When the internal corner is sharp, it may only be solved by requesting a design change that allows a slight radius. A radius will also reduce the buildup on external corners, but these can be shadowed or robbed if necessary. So you might advise the designer to balance the cost of maching a radius against the increased cost of plating.

A current distribution problem can be evaluated by plating in a bath with a particular arrangement of the part and anodes followed by measuring the thickness of the deposit on significant and critical areas.

A problem can also be solved, with an instrument known as a *plating simulator*, by measuring the current distribution over a part that is immersed in a conductive solution.[1] This method is especially useful to measure the current in three dimensions.

A problem can be solved by a two-*dimensional method* of analysis with a conductive paper cutout of a cross section of the part. With this method, a current is imposed on the conductive paper and the equipotential points are located with a probe that is connected through a galvanometer to a voltage divider.[2]

It pays to gain experience by trial and error and by planned experimentation. The resulting bank of experience is handy when the job does not include sample parts or time for measurement and experimentation, so I urge that you examine the part in detail and think of current distribution in terms of throwing power and bath geometry. Consider the general shape of the part and the details of projections, recesses, angles and radii. Consider the tank walls, anode placement, racking, shadowing, and the use of bipolar anodes.

I like to take the time to sketch a

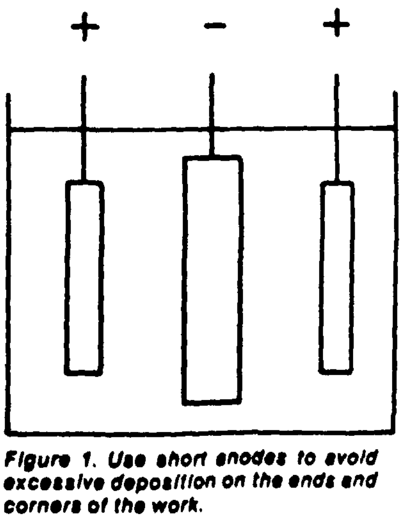

Figure 1. Use short anodes to avoid excessive deposition on the ends and corners of the work.

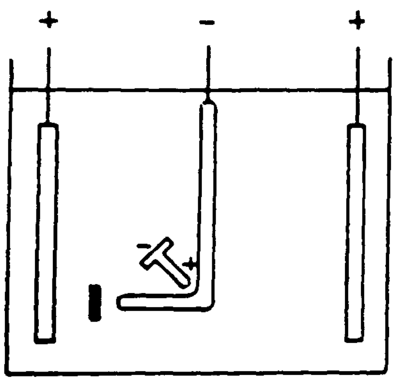

Figure 2. Shadow external projections and use supplemental anodes (or bipolar electrodes) for internal corners.

cross section of a part and estimate the bath geometry. Consider the cross section of an L-shaped part, as in Figure 2, that must be plated to an acceptable uniformity.

My first guess is that the anodes should be a little lower in the solution than the part, that the anodes should be equally distant from the vertical portion, that the bottoms of the anodes should be a little lower than the horizontal portion of the part, that a shadow should be placed to avoid excessive thickness on the left edge of the horizontal portion, and that a bipolar electrode should be used to deposit metal into the inside corner.

Consider the cross section of the S-shaped part in Figure 3. Is the recess in the upper portion of the part generous enough to receive the current? A low efficiency alkaline tin bath would surely throw into this recess, but how about an acid bath at 100% cathode efficiency?

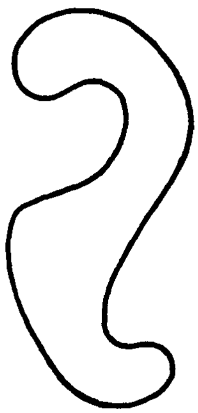

Figure 3. Cross section of an irregular part.

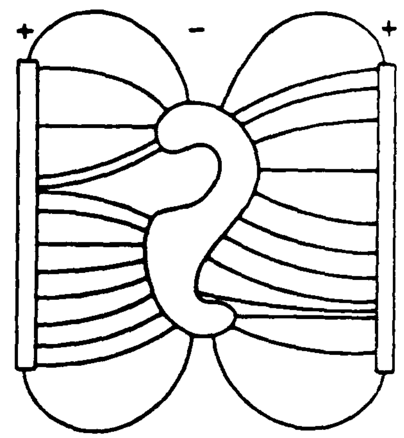

Figure 4. Qualitative current line analysis of an irregular part.

When I draw my guess for the current lines, as in Figure 4, I see that it will be difficult for the current to penetrate the cavity at a sufficient current density to assure a protective thickness.

A drawing of current lines to a cross section of a part is based on the principle that the current enters and leaves the electrodes perpendicularly to the surface, or, more accurately, the current lines are perpendicular to the tangent of the curved surface at the point of contact.

It is also true that the current along a curving line flows from one point on an electrode to a near point on the electrode of opposite sign. Problems with the areas of projections and recesses become apparent when the current lines are drawn with these two principles in mind. The high and low current areas are obvious by examination, but they catch our attention better when the lines are drawn by estimation. It is obvious in Figure 4 that the current will vary greatly and that one low current area will be critical.

Experience teaches us to evaluate potential plating problems by examining the part to be plated. A current line sketch sharpens that experience and actual measurements of the current distribution and plating thicknesses point the way to modification of the tank geometry to favor acceptable plating. MF

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2. Rousselot, R.H., Metal Finishing, 57, 56 Oct. (1959).

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Plating on Difficult-to-Plate Metals

Report of an American Electroplaters' Society Symposium

by D.S. Lashmore, Assistant Editor

D.S. Lashmore

INTRODUCTION

The first AES sponsored symposium on plating on difficult to plate metals was held in New Orleans, Oct. 30-31, 1980. Perhaps instead of the word "metals" in the title, the word "materials" would have been more appropriate, as several of the papers presented concerned plating on ceramics, silicon, and gallium arsenide.

Whether or not a material is considered difficult to plate is of course a subjective judgement and is usually dependent on the plater's previous experience; therefore, it is revealing that of the 18 papers presented, seven concerned electrodeposition onto aluminum substrates, indicating that a broad interest in this subject exists and that a simple process amenable to all alloys still remains to be developed.

The remaining papers dealt with plating on such materials as beryllium, molybdenum, nickel, Kovar, stainless steel, thorium, uranium, titanium, tungsten, lead and zirconium alloys. In Table I, the processes discussed at this symposium are summarized. Only a few of the most successful processes were selected for inclusion in the table.

A broad spectrum of papers was presented at this symposium, ranging from theoretical to practical. Such a format provides a means for interaction between researchers and those involved in commercial plating. This interaction is invaluable for both types of people involved, therefore the organizers are to be congratulated for their excellent format.

The conference got off to a rather sad start as many of us learned for the first time of Harold Wiesner's death. The overview for this symposium which he had previously prepared was read by Bill Harding. In this keynote message, Wiesner stressed the importance of quantitative adhesion testing. All too often in the literature, including in some of the papers presented at this symposium, adhesion is characterized as being excellent, good, poor, or non-existent. Such a classification is useful only to those doing the characterization and has limited meaning to the rest of us.

Wiesner's paper presented a review of the most important literature dealing with typically hard to plate materials. Obtaining adequate adhesion was the goal of most of the processes presented at this conference. It was shown that adhesion can be obtained in a number of ways, such as: (1) metallic bonding, in which the oxide or passive film, covering a metallic surface has to be removed and replaced by a metal coating, (2) mechanical bonding, in which the surface of the substrate has to be etched in such a way that there remain a large number of anchor points into which the subsequent coating can lock or "key" into, (3) mechanical bonding, in which the passive film itself is modified in such a way as to produce keying points, such as by anodizing and (4) A recently patented method brought to our attention in Wiesner's paper (U.S. Patent 4,181,590— 1980) which involves surface modification by ion implantation of noble metals until an oxidation resistant surface is built up.

In summary, an excellent review of the recent literature published since 1970 was presented by Weisner, and his paper would be an excellent starting point for those platers starting to work with these materials. A summary of the papers presented broken down by substrate material is presented below.

zincate on aluminum followed by chrome is better!

ALUMINUM:

Austin Beebe, Federal-Mogul Corp., discussed the fabrication technology involved in the manufacture of steel backed aluminum bearings. Essentially, his paper was concerned with the electrodeposition on an aluminum steel assembly. Significantly over *400 million* such bearings have been produced since 1956.

Beebe departs from the usual procedure for the plating onto aluminum in two ways. First he subjects aluminum clad steel bearings to a rather severe etch, removing between 4 and 5 μm of material. Following a desmutting operation, he zincates the specimens, allowing the immersion reaction to occur for only 10 sec. Then he applies a d.c. current for 20 sec. Apparently the application of this current during zincate immersion allows those portions of the aluminum near the edge of the steel to be coated.

Normally, with only a zincate immersion, the presence of steel on the backside of the bearing results in an impressed potential on the aluminum which inhibits the normal zinc immersion coating near the edge of the

specimen. Following zincating, Beebe normally applies a nickel strike in a near-neutral electrolyte. The actual bearing surface is a ternary lead alloy containing 9-12% tin and 2-3% copper electroplated onto the nickel from a fluoroborate electrolyte.

David Kunces, MacDermid Inc., reviewed the steps used to plate autocatalytic nickel onto several aluminum alloys. He mentioned during his talk that occasionally the zincated aluminum was immersed in a 0.25% sulfuric acid solution to "neutralize" any zincate electrolyte remaining on the surface after rinsing. Most probably this occurs, but also it was shown by this writer that the large zinc crystallites are partially dissolved in the dilute acid, leaving a more uniform zinc surface.

Leo Missel and Greg Kishi, IBM Corp., described a neutral nickel strike used as a replacement for the cyanide copper strike usually used as part of the zincating process. This procedure is so successful that it is now being made part of the ASTM-B253 recommended practice for plating on aluminum.

The advantages of this procedure are (1) it is free of cyanide (2) the nickel electrolyte operates at room temperature, (3) it is not necessary to immerse the zinc coated specimen "live" — this makes the method especially amenable to barrel plating, (4) the electrolyte is unusually stable and requires little maintenance, (5) the nickel deposit is less porous than copper at a comparable thickness, (6) the process is royality free. A description of the process and appropriate references are available in Table I.

Lashmore, National Bureau of Standards, described some of the results of AES Project 41 which dealt with anodizing as a pretreatment prior to subsequent plating (or adhesive bonding). The influence of anodizing parameters on 7146 T6 aluminum was presented. In particular, it was shown that adhesion is a linear function of anodizing voltage.

The first direct transmission electron micrographs of cross-sections through nickel plated on anodizing aluminum reveal that (1) the nickel completely filled the pores and (2) there was no metallic bonding between the nickel and the substrate. It was shown that adhesion of the coating is related most critically to the composition of the anodic film.

As this composition can be controlled by appropriate additions to the

Table 1. Processes Used to Plate on Some Difficult to Plate Metals

Substrate	*Process Summary*	*Peel Test Data*	*Shear*	*Conical Head Tensile*	*Reference*
Aluminum	1. Zincate & copper cyanide strike 2. Zincate & neutral nickel strike 3. Stannate (proprietary) 4. Phosphoric acid anodizing	~100 N/cm 200 N/cm >200 N/cm 50 to 200 N/cm		300-500 MN/m^2	1 2 3 4
Beryllium	Zincate in sodium zincate electrolyte with pH 3.0-7.7 cyanide copper strike as usual on a zincated surface		~250 MN/m^2	170 MN/m^2	11
Beryllium Copper or (Berylco 10$^-$)	HCl pickle: Degrease, caustic soak, pumice scrub, anodic-treat in Oakite 90 for 2 mins. at 268 A/m^2, 1 min. in 18% (by wt) HCl, nickel sulfamate plate as desired		212 (as plated) 431 (400°C for 5 hrs.)		11
Ceramic	Electroless Ni-B (or Ni-P)		15,000 psi.		5
GaAs	Same as Silicon				10
Kovar	Gold: HCl pickle H_2SO_4 pickle & Woods nickel strike Nickel: HCl pickle		163 169 403		12
Lead	Lead fluoborate		12 MN/m^2		11, 13
Magnesium	1. Clean, zincate, copper strike 2. Clean, immerse in 100 g/L ethylenediamine tetramethyl phosphonic acid, pH 6.-7.3, then zincate, copper strike 3. Clean, immerse in 5% HNO_3, zincate, copper strike		113 MN/m^2 143 MN/m^2 145		6
Molybdenum	1. Gold: Clean, etch in alkaline, ferricyanide for 10 sec., rinse, HCl dip (50% vol.), rinse, acid gold strike to deposit 0.06-0.37 μm, rinse & dry, diffuse gold at 1000°C for 30 mins. in H_2, plate gold & again this time up to 0.5 μm, diffuse at 1000°C, then plate as desired 2. Rhodium: Clean, etch in alkaline ferricyanide, rinse, sulfuric acid dip 10 sec. (5-10% vol.). Rhodium strike to deposit 0.06-0.10 mg/cm^2, rinse & dry. Diffuse at 1000°C, 30 min. 10^{-4} torr., repeat deposition of rhodium until 0.5 μm is built up				7
Nickel	Woods nickel strike, 540 A/m^2, 5 mins. Anodic in 400 ml/L H_2SO_4, 1080 A/m^2, 3 mins. Anodic in 100 g/L sulfamic acid, 1080 A/m^2, 3 mins.			711 MN/m^2 762 752	11

Continued on page 5

electrolyte or by predepositing a coating on the aluminum itself, it is forseen that anodizing as a pretreatment may become a more widely used process, not only for plating on those alloys for which it is presently not feasible, but also for adhesive bonding which makes use of a similar sort of process, and most probably involves a similar adhesion mechanism.

Art Wasserman, C.P. Chemicals, Inc., described a brush plating technique for plating nickel directly on etched aluminum. Even though this is a brush plating process, it was shown that this procedure is also amenable to plating on sheet (one side only).

Glen Schaer, Battelle Memorial Institute, described his experience with a zinc alloy immersion process for plating aluminum alloys. In many features the process resembles the British Bondal process in that electrolytes for both contain copper and nickel salts. Schaer also showed that a zinc-cobalt immersion process was capable of providing excellent adhesion.

In his experience the best adhesion resulted from either a cyanide copper strike with free cyanide in excess of 15 g/L or in a pyrophosphate copper strike. He typically measured adhesion by wrapping a piece of plated aluminum wire around itself. Even though this is a qualitative test, it is in the opinion of this writer one of the better qualitative tests available.

CERAMICS:

Don Baudrand, Allied-Kelite Div. of Richardson Co., discussed the deposition of nickel-boron alloys on metallized ceramic substrates. It was found that the ceramic could be made catalytic to the electroless nickel boron electrolyte by incorporating from 1 to 3% by volume of nickel into the ceramic itself. By doing this, the palladium processing step and its associated problems could be eliminated.

MAGNESIUM:

A.L. Olsen, Norsk Hydro A.S., Norway, described a process for plating on magnesium alloys. This process consisted of (1) activation by acid treatment followed by rinsing, then a final alkaline treatment; (2) zincating by immersion in an electrolyte containing zinc sulfate complexed with pyrophosphate.

This zincate also contains flouride ion to control the deposition rate. The

Table 1. Processes Used to Plate on Some Difficult to Plate Metals *(Continued)*

Substrate	*Process Summary*	*Peel Test Data*	*Shear*	*Conical Head Tensile*	*Reference*
Silicon	1. Alkaline electroless nickel boron directly on the unactivated surface				9
	2. Activate with palladium containing HF, HCl, or acetic acid, then plate with electroless gold				10
Stainless Steel	Chromium plating: Clean, etch in 65% sulfuric acid and 5% hydrofluoric acid (1 min., 21°C at 31 A/dm^2). This process may be suitable for other deposits besides chromium				8
Thorium	Nickel: Vapor degrease, caustic clean, rinse, pickle in 830 ml/L HNO_3 plus 2 ml/L HF at room temp. for 10 mins., rinse, anodic etch in 100 ml/L HCl at 538 A/m^2 for 5 mins. at room temperature, rinse. Repeat the HNO_3, pickle, rinse, pickle in 200 ml/L sulfuric acid for 3 mins. at 45–50°C, rinse, electroless nickel plate		146		11, 14
Titanium	1. Pratt & Whitney Process: Abrasive blast, clean in hot alkaline solution, HCl pickle, bright dip in 12% (vol.) HF (70%), 1% HNO_3, bal. H_2O, then anodic etch for 6 mins. at 162 A/m^2, 40°C in 13% (vol.) HF (70%), 83% acetic acid; 4% H_2O. Finally, plate with 25 μm of nickel from a sulfamate solution. Then, heat 2 hrs. at 48°C.		148		11
	2. Ionitech				12
	3. $CrCl_3$-HCl-H_2O: anodic in 210 g/L $CrCl_3 \cdot 6H_2O$ plus 100 ml/L HCl, 10,000 A/m^2, 5 mins. 100°C		177 MN/m^2		11
	4. $CrCl_3$-HCl: Anodic in 210 g/L $CrCl_3 \cdot 6H_2O$ diluted to 1 liter with conc. HCl (37 wt.%), 6,000 A/m^2, 10 mins. 100°C.				11
Tungsten	Clean, etch in 3 parts HF, 1 part HNO_3, and 4 parts H_2O for 5 mins. at 50°C, nickel plate (a chromium strike might improve adhesion prior to nickel plating)		22 MN/m^2		15, 11
Tungsten-Nickel-Iron	Same as above		235 MN/m^2		15, 11
Uranium (pure)	Etch in 1,400 g/L for 10 mins. at 43°C ferric chloride, then nickel plate		371 MN/m^2		16, 11
Zircaloy	Vapor degrease, cathodic alkaline, clean. Immerse in 15 g/L ammonium bifluoride, ½ ml/L H_2SO_4, 1 min. at 22°C then nickel plate after heating at 700°C, 1 hr.		15–25 MN/m^2 ~38 MN/m^2		11

process is said to be adaptable to barrel plating. The subsequent strike over the zinc can be of any type so long as it is compatible with plating on the zinc layer.

J.W. Dini, Lawrence Livermore National Labs., and H.R. Johnson, Sandia Labs., described a process similar to Olsen's and showed that the use of an acid pickle improved adhesion from 113 MN/M² to 145 MN/M². Heating the zincated magnesium yields no increase in adhesion, indicating that the maximum adhesion possible was most probably obtained simply from correctly operating the immersion process. These processes are summarized in Table I.

MOLYBDENUM:

D.J. Levy, C.R. Arnold and D.H. Ma, Lockheed Research Laboratory, described a procedure for plating gold directly over the oxide which normally covers a molybdenum surface. After plating, the oxide was then reduced by thermally treating the specimen in hydrogen. Rhodium was also plated on molybdenum by this technique, though in this case the bonding was achieved by thermal diffusion *through* the oxide.

SUPERALLOYS AND STAINLESS STEEL:

W. Baldauf and E.S. Chen, Watervliet Arsenal, reported a method for activating superalloys and stainless steel for chromium plating. They experimented with chromic acid and sulfuric acid solutions without success. They found that the best adhesion was obtained with mixtures of sulfuric and hydroflouric acids.

Their best procedure involved a mixture of 65% by volume sulfuric acid with 5% by volume HF used anodically at 21°C and at 30 A/dm² for 1 min. This procedure was found to work on Types 304, 316, 410 and superalloy U-700. Adhesion was evaluated using a groove test run on a shaper in combination with observation of the resultant groove by optical microscopy.

SEMICONDUCTORS:

Kei Yoshida, Bell Labs., described the deposition of Ni-P alloys from an electroless bath onto silicon for use as ohmic contacts. It was shown that a significant difference exists between *n* and *p* type material. The *n* type is far more easy to plate. Yoshida offered several explanations of this phenomena.

The nitrate ion was shown to be very detrimental to the adhesion of a Ni-P alloy to the silicon and therefore a great deal of care went into obtaining a high purity (nitrate free) nickel to make up the initial electrolyte. The flouride ion was also shown to be detrimental, especially for *p* type material. During the discussion of this paper, D'Asaro proposed that light be shown on the p-type material in order to raise the Fermi level and thereby give the surface more of an electron donor (*n* type) character.

L.A. D'Asaro, S. Makahara and Y. Okinaka, Bell Labs., discussed the role of palladium catalysts in the electroless gold plating of gallium arsenide and silicon. It was shown that the bonding of palladium to the substrate was a result of the reduction of Pd^{2+} ions by galvanic displacement. The activation electrolyte contained $PdCl_2$, HCl, acetic acid, or H.F. Therefore, subsequent adhesion of the gold to the substrate is critically dependent on the nature of this bond. A transmission electron microscopic (TEM) study of the Pd deposited on various semiconductor surfaces was therefore expected to yield insight into the adhesion process.

The semiconductors examined in this investigation were (110) GaAs and (111) Si which were thinned to electron transparency before deposition of the Pd. The results of this study indicate that on GaAs the Pd was fine grained and covered about 80% of the surface area of the substrate. On Si, the grain size was much coarser. The adhesion of subsequent coatings was related to the Pd distribution, being quite poor on Si and good on GaAs. The difference between *n* and *p* type silicon noted by Yoshida were not noted by D'Asaro.

TITANIUM, BERYLLIUM, KOVAR, LEAD AND MAGNESIUM:

J.W. Dini and H.R. Johnson discussed techniques developed over a number of years for plating on a wide variety of difficult to plate materials. Many of these techniques involve either etching the surface to provide mechanical bonding, or by providing a displacement coating to which bonding is facilitated. One of the many important contributions of Dini and Johnson was the introduction of a relatively easy to use quantitative adhesion test—the ring shear test. Data from this test is listed in Table I wherever available, along with peel test data and conical head tensile test data.

Beryllium is plated using a zincate whose pH was found to be relatively unimportant (3.0 to 7.7). Beryllium-copper alloys required an HCl pickle prior to a nickel strike. Electroless Ni-P was not found to work well on this alloy.

On Kovar the pretreatment procedure was not critical, a simple HCl pickle being quite adequate. Lead can be plated onto lead from a flouroborate electrolyte by simply immersing the specimen into the electrolyte for two minutes prior to applying a current. Magnesium is plated much like aluminum with the optimum procedure involving a 5% HNO_3 pickle followed by the zincate immersion and then a copper strike (pH 10.3).

SUMMARY

The conference as a whole was an enjoyable and worthwhile experience. It was very well organized, as most AES conferences are. If it had any drawbacks it was that several of the speakers felt that they had to read their papers. MF

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